AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Published by Howes Publishing Company, 90 William Street, New York.

Devoted to the practical application of dyestuffs in all industries; especially to textile chemistry—the science and practice of scouring, bleaching, dyeing and finishing.

VOLUME XVI NEW YORK, FEBRUARY 7, 1927 No. 2

Dye Solution Phenomena with Variation in Hydrogen Ion Concentration

With Particular Reference to Dye Identification

By WALTER C. HOLMES* and JULIUS F. T. BERLINER†

(One Hundred and Twenty-sixth Contribution from Color Laboratory, Bureau of Chemistry, Washington, D. C.)

COMPARATIVELY little information is available in the literature respecting the behavior of aqueous solutions of dyes with variation in hydrogen ion concentration. Limited data bearing upon indicator application have been collected and tabulated by Clark in his "Determination of Hydrogen Ions." Somewhat indefinite information on the behavior of dyes in general with acids and alkalies is also recorded in Schultz's "Farbstofftabellen" and in the more comprehensive tables of the "Colour Index of the Society of Dyers and Colourists."

The latter material is intended, primarily, to serve as an aid in dye identification but its utility is limited. The use of numerous and definite color terms would greatly facilitate differentiating between many dyes of similar but not identical color. The specification of the definite conditions under which color changes occur would frequently enable the analyst to distinguish further between dyes of similar or identical color, even when the dyes in question belong to the same dye group. The ethylbenzyl substitution, for example, renders the dyes of the (diamino) triplenylmethane group much more resistant to acidity than does the diethyl substitution and it is only necessary to observe the effect of a suitable definite degree of acidity in order to distinguish between Patent Blue A and Xylene Blue AS, on the one hand, and Patent Blue V and Xylene Blue VS on the other.

The system described below has been adopted at the Color Laboratory of the Bureau of Chemistry for the routine examination of dye solution with definite concentrations of hydrogen and hydroxyl ions. The records of such examinations are filed and have frequently proved very useful for dye identification and other purposes.

A set of stock test-solutions is used to supply an acidity-alkalinity range with nineteen divisions. The extreme acid range consists of conc. sulphuric acid (95 per cent), conc. hydrochloric acid (36 per cent), 18 per cent hydrochloric acid (pH 1), 4.65 per cent hydrochloric acid (pHO) and a molecular solution of hydrochloric acid (pH 1). The standard buffer solutions of Clark (loc. cit.) are employed for pH 2, 6, 7, 8, 9 and 10. Phthalate-sodium hydroxide buffers are unsuitable for use with basic dyes and the Clark buffer solutions for pH 3, 4 and 5 are replaced, accordingly, by solutions containing per liter, respectively, 205.5 c.c. .2M. secondary sodium phosphate with 400 c.c. .2M. citric acid, 385.5 c.c. .2M. secondary sodium phosphate with 307.5 c.c. .2M. citric acid and 618 c.c. .2M. secondary sodium phosphate with 291 c.c. .2M. citric acid. The extreme alkaline range consists of .01M. sodium hydroxide (pH 13), .1M. sodium hydroxide (pH 14) and 10 per cent sodium hydroxide.

A series of color standards, prepared in the following manner, is used: Metanil Yellow (C. I. No. 138) is adopted for yellow (Y), Amaranth (C. I. No. 184) for red (R) and New Patent Blue 4B (C. I. No. 734) for blue (B). The dye concentration of the solutions recommended is such as will necessitate the consumption of 2.99, 1.17 and 1.01 c.c. .01N. $T.Cl_3$ solution, respectively, in the reduction and decolorization of 100 c.c. of the color solutions. Combining these primary solutions in various proportions gives a series of color standards which cover the entire spectrus in twenty-four graduations.

The yellow-to-red series, for example, is obtained as follows:

10 c.c. yellow sol.	Y
8.75 c.c. yellow sol. + 1.25 c.c. red sol.	2YO
7.50 c.c. yellow sol. + 2.50 c.c. red sol.	YO
6.25 c.c. yellow sol. + 3.75 c.c. red sol.	Y2O
5.00 c.c. yellow sol. + 5.00 c.c. red sol.	O
3.75 c.c. yellow sol. + 6.25 c.c. red sol.	2OR
2.50 c.c. yellow sol. + 7.50 c.c. red sol.	OR
1.25 c.c. yellow sol. + 8.75 c.c. red sol.	O2R
10 c.c. red sol.	R

*Associate chemist, Color Laboratory, Bureau of Chemistry.
†Junior chemist, Color Laboratory, Bureau of Chemistry.

	Conc. H_2SO_4	Conc. HCl	PH -1	PH 0	PH 1	PH 2	PH 3	PH 4	PH 5	PH 6	PH 7	PH 8	PH 9	PH 10	PH 11	PH 12	PH 13	PH 14	10% NaOH
Fuchsine (DeP) C. I. No.677	Y	Y	Y	Y soon decol.	←2RV soon decol.	R→ much decol. in 10 min.	R→	R	R	R	R	R much decol. in 24 hrs.	R decol. in 2 hrs.	R decol. in 1.5 hrs.	R decol. in 45 min.	R decol. in 2.5 min.	R decol. in .5 min.	O pptte	O pptte
Red Violet (tM) C. I. No.679	Y	Y	Y	Y soon decol.	RV soon decol.	RV much decol. in 20 min.	2RV gradually turning sl. bluer	2RV	2RV	2RV	2RV	2RV sl. decol. in 24 hrs.	2RV much decol. in 5 hrs.	2RV decol. in 3 hrs.	2RV decol. in 1.5 hrs.	2RV decol. in 4 min.	2RV decol. in 1 min.	O pptte	O pptte
Methyl Violet 2B (MAC) C. I. No.680	Y	Y	Y	G2Y-Y soon decol.	2BG-BG decol. in 1-2 hrs.	←VB gradually becoming bluer	←V	B2V→	B2V→	B2V→	B2V→	B2V→	B2V→ sl.bluer & weaker after 24 hrs.	B2V→ nearly decol.after 24 hrs.	B2V→ much decol. in 5 hrs.	B2V→ decol. in 30 min.	B2V→ decol. in 4 min.	B2V→ red pptte after few seconds	R pptte
Crystal Violet (MAC) C. I.No. 681	Y	Y	Y	G2Y-Y soon decol.	BG→ decol. in 1-2 hrs.	V2B bluer and weaker after 24 hrs.	2VB→ slowly turning sl. bluer	←V	←V	←V	←V	←V	←V bluer and weaker after 24 hrs.	←V decol.after 24 hrs.	←V much decol. in 5 hrs.	←V decol. in 30 min.	←V decol. in 3 min.	←V decol. in few sec.	decol.at once
Benzyl Violet (MAC) C. I. No.684	Y	Y	Y	←G2Y gradually decol.	2BG→ decol. in 1-2 hrs.	←V2B bluer and weaker after 24 hrs.	2VB slowly turning sl. bluer	V-2VB	V	←V	←V	←V	←V bluer and weaker after 24 hrs.	←V decol.after 24 hrs.	←V much decol. in 5 hrs.	←V decol. in 30 min.	←V decol. in 3 min.	←V decol. in few sec.	decol. at once
Ethyl Violet (B) C. I. No.683	Y	Y	Y	Y gradually decol.	GY-G2Y decol. in 1-2 hrs.	B2G-G decol.after 24 hrs.	V2B-B decol.after 24 hrs.	2VB	V-2VB	V-2VB	V-2VB	V-2VB	V-2VB weaker after 24 hrs.	V-2VB much decol. after 24 hrs.	V-2VB decol. after 24 hrs.	V-2VB decol. after 1 hr.	V-2VB decol. in 10 min.	V-2VB decol. in 1 min.	V-2VB decol. in .5 min.
Pyronine G (Providence Chem.Lab. C. I. No.739	Y-2YO	YO	YO-Y2O	R	R-2RV	R-2RV	R-2RV part pptte	R-2RV part pptte	R-2RV part pptte	R-2RV part pptte	R-2RV part pptte	R-2RV part pptte	R-2RV part pptte	R-2RV part pptte	R-2RV sl.decol. after 24 hrs.	R-2RV soon decol.	R-2RV sl. pptte soon decol.	R-2RV pptte decol. in few sec.	R-2RV pptte decol. at once
Pyronine B (MAC) C.I. No. 741	2YO	YO-Y2O	←Y2O	OR	R-2RV	←2RV	2RV	2RV	2RV	2RV	2RV sl.pptte	2RV sl.pptte	2RV sl.pptte	2RV sl.pptte sl.decol. after 24 hrs.	2RV sl.pptte much decol. after 2 hrs.	2RV sl.pptte soon decol.	2RV part pptte soon decol.	2RV pptte	2RV pptte
Rhodamine S (By) C. I. No.743	Y	Y2O	Y2O-O	2RO-R	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV sl.decol. after 24 hrs.	R-2RV decol. after 24 hrs.	R-2RV much decol. in .5 min.	R-2RV quickly decol.	R-2RV quickly decol.
Rhodamine B (B) C. I. No.749	←Y	Y2O→	Y2O-O	OR	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV slowly turning bluer
Rhodamine G (By) C. I. No.750	←Y	←Y2O	Y2O	OR	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV	R-2RV slowly turning bluer
Rhodamine 3B (Klip) C. I. No.751	Y	2YO-YO	YO	O-2OR	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→ sl.pptte sl. turns bluer
Rhodamine 6G (Klip) C. I. No.752	Y-2YO	2YO	←YO	O	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→	2OR→ much decol after 24 hrs.	2OR→ much decol. after 24 hrs.	OR part pptte	O2R part pptte
Quinoline Red (Kahlbaum) C. I. No.805	decol.	decol.	←O2R part decol.	←O2R part pptte.	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR→	←O2R sl.pptte
Cyanine (Color Lab.) C. I. No.806	decol.	decol.	decol.	decol.	deçol.	decol.	decol.	decol.	decol.	decol.	decol.	←2VB	←2VB	←2VB	←2VB	←2VB	←2VB	V-2VB	←V
Dicyanine (Color Lab.) C. I. No.811	decol.	decol.	decol.	decol.	decol.	decol.	decol.	decol.	decol.	←2VB	2VB	2VB	2VB	2VB	2VB	2VB	2VB slow part pptte	2VB part pptte	nearly decol.
Tolulene Red (Geisenheimer) C. I. No.825	B	OR pptte	OR pptte	OR	OR-O2R	OR-O2R slow pptte	OR-O2R slow pptte	OR-O2R pptte	OR-O2R pptte	OR-O2R pptte	OR-O2R pptte	OR-O2R	OR-O2R	OR-O2R slow pptte	OR-O2R slow pptte	OR-O2R slow pptte	OR-O2R pptte (redissolves)	OR-O2R	OR-O2R
Induline Scarlet(B) C. I. No.827	R	B2G	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	OR sl.pptte	2RV part pptte	2RV pptte	2RV pptte
Safranine B extra (B) C. I. No. 840	BG-B2G	←V2B	V	2RV	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	2OR	OR	R part pptte

Safranine O (MAC) C. I. No.841	O	RO-RB	2YB	RY	←O2R	O2R-O2B	O2R-O2B	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	R part ppte
Safranine GB (MAC) C. I. No.843	O	RO	←Y	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY-RV part ppte
Rhoduline Violet (By)	BO-O	RO	2YB	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	RV ppte
C. I. No.844 Rhoduline Red 2B (By) C. I. No.844	RO	RO-RB	V2B	V	R-2RY	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	OR ppte
Rosolane O (MLB) C. I. No.845	2OY	R→	2YB-B ppte	V ppte	RV	RV	RV	RV	RV	RV	RV	RV	RV	RV	RV	RV	V ppte
Crewyl Fast Violet (MAC)	O	RO	Y	OBY soon turns Y and is part decol.	2OY	R2O decol. quickly	←V2B	←V2B	←V2B	←V2B	←V2B	←V2B	←V2B decol. after 24 hrs.	←V2B sl.decol.	←V2B soon decol.	decol.	red ppte
Gallo Violet D (By) C. I. No.821	V2B	YB-V2B	←RV	2RY→	2RY	2RY	←YB part ppte	YB part ppte	YB part ppte	YB part ppte	YB part ppte	YB part ppte	RBY ppte	RBY ppte	RV ppte	RV	RV
Methylene Violet, Bernthsen (MAC)	2VB	2VB-VB	←V	←V	←V	V→	←YB	←YB	YB→	VB-V2B	VB-V2B	VB-V2B	VB-V2B	VB-V2B	VB-V2B	VB-V2B	R-2YB slowly turning 2RY
Rhonine (MAC)	2OY	B	YB→	R2Y-V	R2Y-V	R2Y-V	←V	←V	←V	←V	←V	←V	←V	←V	←V	2RY part ppte sl. turning RV	O ppte
C. I. No.920																	

Safranine O (MAC) C. I. No.841	O	RO-RB	2YB	RY	←O2R	O2R-O2B	O2R-O2B	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	O2B-O2R	R part ppte
Safranine GB (MAC) C. I. No.843	O	RO	←Y	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY-RV part ppte
Rhoduline Violet (By)	BO-O	RO	2YB	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	2RY	RV ppte
C. I. No.844 Rhoduline Red 2B (By) C. I. No.844	RO	RO-RB	V2B	V	R-2RY	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	R→	OR ppte
Rosolane O (MLB) C. I. No.845	2OY	R→	2YB-B ppte	V ppte	RV	RV	RV	RV	RV	RV	RV	RV	←V2B sl.decol. after 24 hrs.	←V2B sl.decol.	←V2B soon decol.	decol.	V ppte
Crewyl Fast Violet (MAC)	O	RO	Y	OBY soon turns Y and is part decol.	2OY	R2O decol. quickly	←V2B	←V2B	←V2B	←V2B	←V2B	←V2B	←V2B	←V2B	←V2B	decol.	red ppte
Gallo Violet D (By) C. I. No.821	V2B	YB-V2B	←RV	2RY→	2RY	2RY	←YB part ppte	YB part ppte	YB part ppte	YB part ppte	YB part ppte	YB part ppte	RBY ppte	RBY ppte	RV ppte	RV	RV
Methylene Violet, Bernthsen (MAC)	2VB	2VB-VB	←V	←V	←V	V→	←YB	←YB	YB→	VB-V2B	VB-V2B	VB-V2B	VB-V2B	VB-V2B	VB-V2B	VB-V2B	R-2YB slowly turning 2RY
Rhonine (MAC)	2OY	B	YB→	R2Y-V	R2Y-V	R2Y-V	←V	←V	←V	←V	←V	←V	←V	←V	←V	2RY part ppte sl. turning RV	O ppte
C. I. No.920																	

The remaining color range of 2RV, RV, R2V, V, 2VB, VB, V2B, B, 2BG, BG, B2G, G, 2GY, GY and G2Y is obtained in a similar manner by combining the red and blue and the blue and yellow solutions.

Further intermediate differentiation in color is recorded by means of symbols. In the color range between O2R and R, for example, a hue which is midway between the standards is recorded as O2R-R, while hues intermediate between the latter and the standards are recorded, respectively, as O2R→ and ←R. The system provides a color nomenclature of ninety-six terms by means of which color may be specified with considerable precision.

The color standards at this laboratory (in stoppered culture tubes) have undergone no appreciable alteration in any particular over a period of a year. Apart from supplying the basis for a relatively definite color nomenclature, they also serve as guides in regulating color intensity in the preparation of dye solutions for examination.

In the examination of a dye, a stock solution of indefinite strength is prepared, and the number of drops required to color 10 c.c. of water with the approximate intensity of the nearest color standard determined. That amount of dye solution is then added to 10 c.c. of each of the standard test solutions contained in culture tubes (or test tubes) of the same diameter as those containing the color standards. The test solutions are then shaken and compared, and all immediate modifications in color or other alterations noted and recorded. They are further observed from time to time, and after twenty-four hours for evidence of gradual alterations which may develop. In the instance of dyes with decided colloidal tendencies which may be precipitated by buffer agents, it may prove advisable to repeat the tests with diluted buffer solutions. The complete record of observations is filed for reference under the name of the dye, and a duplicate record is filed under the precise color of its neutral solution.

Representative data on red and violet basic dyes are recorded in the table by way of illustration.

Such data reveal the range in hydrogen ion concentration in which the dyes are stable and enable the analyst to determine whether or not hydrogen ion control is necessary or advisable in colorimetric and spectrophotometric technic, and to decide upon suitable conditions in instances in which such control is advantageous. They define the possibilities of the dyes in indicator application. They disclose the zones of alteration of dyes in which the analyst may wish to determine precise spectrophotometric ratios for purposes of ultimate identification.* They sometimes reveal decided colloidal tendencies in dyes which may necessitate unusual precautions in analytical technic.

*Holmes, J. Ind. Eng. Chem. **15**, 833 (1923); **17**, 59 (1925); **17**, 918 (1925).

Their principal utility, however, is doubtless found in the identification of dyes. The general character of the modifications of the solutions of any class of dyes with varying concentrations of hydrogen and hydroxyl ions is usually distinctive. In differentiating between the individual dyes of a given class reliance is placed upon differences in color and upon the variation in behavior which arises in variation in degree of susceptibility to the action of hydrogen and hydroxyl ions.

Between dyes of closely related constitution such differences in color and behavior may sometimes be too slight to afford a satisfactory means of certain differentiation, and it may be necessary to resort to spectrophotometric methods or other means in order to obtain a positive identification.

SUMMARY

A system is outlined whereby the behavior of aqueous solutions of dyes with variation in concentration of hydrogen and hydroxyl ions is determined and recorded. The data obtained find their principal utility in the identification of dyes.

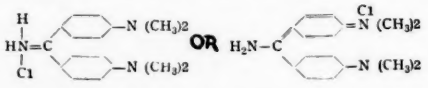
Testing Dyes for the Paper Industry

By DR. AUGUST NOLL

(*Papier-Fabrikant, September* 26, 1926)

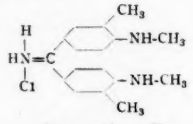
Translated by Dr. Paul Bartholow

AURAMINE belongs to the class of basic dyestuffs, and is derived from diphenylmethane. The ordinary Auramine of commerce is known as concentrated Auramine, Auramine O, or Auramine II, according to its color strength. When produced by condensation of tetramethylparadiamidobenzophenon (Michler's ketone) with ammonium chloride it is to be regarded as the chlorhydrate of tetramethyl-p-diamidobenzophenonimid, according to the following formula:



In aqueous solution at high temperature and especially in the presence of acids this substance is unstable, in consequence of hydrolytic decomposition into a ketone and ammonium chloride. This supplies the reason why samples of Auramine should not be disssolved in water above 60 to 70 deg. at the highest.

Besides the product mentioned above, there is to be found in commerce an Auramine G, which dyes a greener yellow, but is otherwise not distinguishable from the others. This dyestuff is obtained by condensation with ammonium chloride from the symmetrical dimethyldiamido-o-ditolylketone (the latter obtained from monomethyl-o-toluidine and phosgene), and, similarly in aqueous solution at high temperature it undergoes hydrolytic decomposition into ketone.



Auramine G

Chlorhydrate of 4-4 dimethyldiamido-3-3-dimethylbenzophenonimid

From the difference in melting points between the ketones, which may be isolated in this manner, it is possible, as shown below, to make a qualitative distinction between the G sample and the other grades of Auramine, and from the product prepared from Mischler's ketone, it is possible to determine the color strength according as the ketone is isolated.

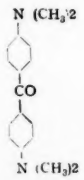
In the next place some other experiments in preparing Auramine dyestuffs may be described, namely:

PRODUCTION OF PURE AURAMINE FROM TECHNICAL PRODUCT

Auramine conc. (BASF) is about 92 per cent pure; Auramine Extra-Conc. (Hoechst) about 92 per cent; Auramine O (Hoechst) about 60 to 70 per cent; Auramine O (BASF) about 60 to 70 per cent. As dilutents the following may be considered: sodium chloride, sodium nitrate and, in some circumstances, dextrine. For the isolation of these substances one proceeds as follows: 100 grams of technical Auramine are heated for a while with three-quarter liter of strong alcohol over the water bath. The dyestuff dissolves easily in warm alcohol, while sodium chloride, sodium nitrate and dextrine remain behind. The hot solution is filtered while hot and the residue of salt is subsequently treated further with some warm alcohol. The filtrate is allowed to crystallize. From the mother liquor, by partial concentration, further substances may be obtained. The preparation is 100 per cent pure.

TETRAMETHYL-P-DIAMIDOBENZOPHENON

Production by decomposition of auramine:

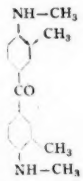


Fifty grams of Auramine O (chlorhydrate of tetramethyl-p-diamidobenzolphenonimid) are covered with 50 c.c. of raw hydrochloric acid and about 500 c.c. of water added. The whole quantity of Auramine is dissolved, and then boiled for one-quarter of an hour, until the coloring properties have disappeared. The dyestuff is now decomposed into ketone and ammonium chloride.

Particles of dirt in the solution are filtered off. By means of thorough shaking or stirring the solution is made alkaline with soda lye at the boiling temperature. The raw ketone is precipitated in gray flocculi, removed by suction and thoroughly washed. The raw product is crystallized out from alcohol, in which state it is pure, colorless to slightly yellowish flakes, with a boiling point of 173.

Qualitative Differentiation Between Various Auramine Samples

Auramine O Conc., Auramine Extra Conc., and Auramine II are derived from tetramethyl-p-diamidobenzophenon. They are to be distinguished solely in their color strength and degree of solubility.



Auramine G is derived from dimethyldiamino-o-ditolylketone (from monomethyl-o-toluidin). For the identification of this substance the dyestuff is disssolved (after wetting with hydrochloric acid) in water, and boiled for about one-half hour. The insoluble particles of dirt are filtered off. Through boiling decomposition into ketone and ammonium chloride occurs. The boiling solution is well shaken and rendered alkaline. The raw ketone is precipitated in flocculi. It is withdrawn by suction, thoroughly washed, crystallized out from alcohol, and melting point determined. Tetramethyl-p-diamidobenzophenon has a melting point of 172 deg. Dimethyldiamido-p-ditolylketone melts at 80 to 81 deg., and consequently during boiling separates into an oily state and is a proof of the presence of Auramine G.

In the case of Auramine O, Conc., II, Extra Conc., which are derived from tetramethyl-p-diamidobenzophenon, it is possible through the elimination of the nearly insoluble ketone, to determine a color strength sufficient for technical purposes. One proceeds as follows: A carefully weighed amount of the sample of the dyestuff (about 3 grams) is sprinkled over with a few cubic centimeters of hydrochloric acid and then dissolved in 200 c.c. of water. The particles of dirt are filtered from the solution and the filter is washed. The filtrate is then heated and kept at the boiling point for one-quarter hour, whereby separation of the ketone occurs.

The hot solution is carefully rendered alkaline (stirring and litmus paper) and again boiled for a short time. The large flakes of precipitated ketone are collected on a filter, washed with water, dried at 100 deg. and weighed. For the calculation of the percentages the following molecular weights hold good: Chlorhydrate of the dyestuff molecular weight, 303.5; molecule of ketone, 268; imid-base molecular weight, 267. Hence 268 parts of the separated ketone correspond to 303.5 parts of 100 per cent dyestuff, or the ketone when multiplied with the factor 1,132 gives the dyestuff content. Example:

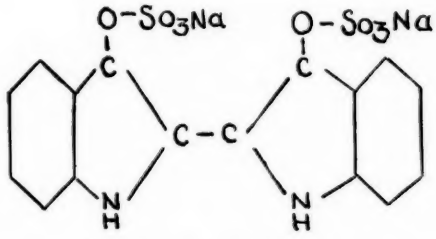
Quality of dyestuff applied....3,000 grams
After weighing .....2,150 grams of ketone

The sample consequently contains:

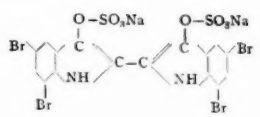
$$\frac{2{,}150 \times 1{,}132 \times 100}{3} = 81.12 \text{ per cent of pure dyestuff}$$

chlorhydrate. With regard to the determination of the color strength of this grade of the dyestuff Auramine G, we can proceed in an analogous manner, though with this difference—that the oily ketone (dimethylamino-o-ditolylketone) which is separated in the presence of acids, is treated with ether, evaporated to dryness and weighed. The calculation of the molecular weights is the same as that described above, since both ketones are isomeric.

Under the designation "Indigosols," soluble indigo derivatives have of late been put on the market, which in contrast to the use of Indigo in vat dyeing, in the form of soluble salts fix their esters on the fibers of woolens, so that they may subsequently be regenerated by the action of oxygen. Up to the present time two of these derivatives have been put on the market, namely, Indigosol O, which represents the disodium salt of the sulphuric acid ester of indigo white, according to the formula:



Further, the designation Indigosol O4B is that of a derivative, the disodium salt of sulphuric acid ester of leuco-5-7-5-7 Indigo tetrabromide:



Both dyestuffs are grayish-white powders, easily solu-

ble in water and fast to alkalies, and only decompose in the presence of acids after long boiling. On the other hand, these preparations cannot undergo drying in the autoclave at 100; under these conditions decomposition into ether salts occurs as manifested by the appearance of a blue color. Oxidizing substances, such as sodium nitrite, ferric chloride and bichromate, however, cause a momentary decomposition of the ether salts with the quantitative separation of the dyestuff. These products also may be diluted to any desired color shade by neutral salts, like sodium chloride and Glauber salt, on which account the consumer has a great interest in their color strength. So far a method of determining this strength is wanting, but I have devised the following based on the decomposition of the ether salts through oxidation. About 4 grams of Indigosol O, or one-half gram of Indigosol O4B were carefully weighed and dissolved in about 100 c.c. of water and heated. The substance readily dissolves, the solution was filtered and the undissolved particles of dirt are removed. The filtrate is acidified with sulphuric acid, slightly heated, and treated with a solution of sodium nitrite, until the quantitative separation of the Indigo tetrabromide has taken place. The completeness of the isolation of this substance is determined by adding more of the nitrite solution to the filtrate. After standing, the solution is filtered, washed, and dried at 100 deg. The residue gives the content of pure Indigo, that is, Indigo tetrabromide within the active dyestuff in the commercial product.

MARKETING LAUNDRY SPECIALTIES IN ITALY

In the course of an investigation of the Italian market for laundry appliances, Commercial Attache H. C. MacLean, Rome, compiled a list of the steam laundries and dealers in steam laundry supplies in Genoa and Turin. No steam laundries could be found in operation in Naples. Interested accredited firms can obtain a copy of the trade list upon application to the Commercial Intelligence Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Chemical Treatment of Trade Waste*

Part II—Wastes from Silk Dyeing

By FOSTER D. SNELL and DONALD S. BRUCE

Pratt Institute, Brooklyn, N. Y.

THE plant supplying the data given is a relatively small piece-dye works having a discharge of 100,000 gallons of waste water per day, mainly within ten hours. The plant dyes silk and silk-and-cotton goods, principally with direct dyes. About 300 pounds of soap are used per day with bleaching powder, silicate of soda, hydrogen peroxide, and small amounts of other chemicals.

This particular set of results was selected because it was in more complete form than that of several other plants. Similar data have been collected from others with daily discharge up to 4,500,000 gallons, and the same treatment has been applied with equally satisfactory results.

The plant is subject to the rulings of the Passaic Valley Sewerage Commission and is or will soon be compelled to treat the waste in such a way that 90 per cent will be substantially colorless and harmless to fish or plant life when discharged into the river. The discharge of the remaining 10 per cent of the waste into the Passaic Valley Trunk Sewer is permitted provided it contains nothing which will be injurious to the structure of the sewer.

A preliminary study of the dye waste was made on three samples so taken as to each represent an average day's discharge. For the purpose, determinations of total solids, loss on ignition, oxygen consumed, and color readings are sufficient.† Laboratory study indicated that treatment of these average dye wastes with five pounds of copperas and four pounds of lime per thousand gallons would give a satisfactory effluent. The data on these samples before and after this treatment are given in Table I:

Table I—Analysis of Dye Wastes

	Effluent 1		Effluent 2		Effluent 3	
	Before	After	Before	After	Before	After
	P. p. m.	*P. p. m.*	*P. p. m.*	*P. p. m.*	*P. p. m.*	*P. p. m.*
Total solids	1896	1750	3234	2894	1618	1590
Loss on ignition	768	288	710	372	452	250
Oxygen consumed	240	49	266	85	415	126
	Lovibond Units per 50.8 mm. Layer					
Red	7.0	2.6	5.0	2.0	10.0	2.5
Blue	3.5	0.0	6.0	0.0	11.0	0.0
Yellow	8.0	2.0	6.0	2.0	8.0	2.0

In addition to the dye wastes there are a number of others occurring at more or less frequent intervals. These are a mercerizing liquor, a sour, silk and silk-and-cotton boil-offs, a hypochlorite bleach, and a peroxide bleach. Typical samples of each of these were analyzed with the results indicated in Table II.

*Presented under the title "Chemical Purification of Wastes from Silk Dyeing" before the Division of Water, Sewage and Sanitation at the 69th meeting of the American Chemical Society, Baltimore, Md., April 6 to 10, 1925, and published in Industrial and Engineering Chemistry, February, 1927.

†Part I of this article appeared in the American Dyestuff Reported, January 24, 1927.

Variation in Composition

Liter samples were taken at half-hour intervals on two separate days, about ten days apart, from a sump into which all the liquors were discharged. These gave results which are summarized in the accompanying graphs.

Table II—Analysis of Other Wastes

	Silk Boil-Off	Silk and Cotton Boil-Off	Hypochlorite Bleach
	P. p. m.	*P. p. m.*	*P. p. m.*
Total solids	11,334	11,252	24,690
Loss on ignition	1,326	6,522	4,210
Oxygen consumed	2,864	1,742	
Alkalinity	0.0047 *N* (phen.) 0.0500 *N* (m. o.)	0.0141 *N* (phen.) 0.0473 *N* (m. o.)	
Alkalinity of mercerizing liquor		0.293 *N* (phen.)	
Acidity of sour liquor		0.023 *N* (m. o.)	
Oxygen consumed by peroxide bleach, p. p. m.		48.8	

Fig. 1 gives the total color readings obtained on the first day's samples after 1:9 dilution. Of the two peaks, one was of blue and one of red. The blue bath at 10 a. m. was found to be much less difficult to treat than the less intense red one at 6 p. m. Fig. 2 shows the second day's average with no such extreme. Satisfactory color readings could not be obtained on the 11 o'clock sample on the first day because it contained a large amount of silk boil-off liquor. These graphs do not include the other miscellaneous discharges mentioned, as these are mainly discharged at night or in the early morning. They are not objectionable as to color.

The data for solids are plotted in Fig. 3, and show only one high peak, at 11 a. m. This is due to the discharge of a boil-off at 10.45 a. m. This liquor is to be diverted. The peaks of solids at 4.30 and 5.30 p. m. are mainly inorganic and not objectionable.

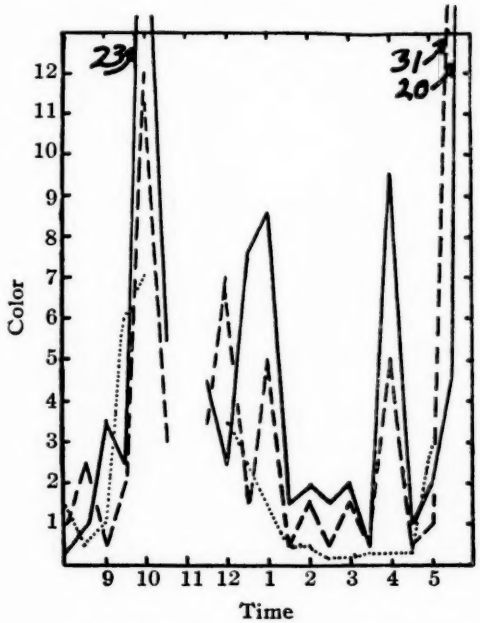


Fig. 1.—*Total Color in Lovibond Units per 50.8 mm. Layer on First Day's Samples.*

Original color in 1:9 dilution ——— solid line. Color after treatment of half-hour average (without dilution) — — — — dash line. Color after treatment of hour average (without dilution) ..... dot line. All values which include 11 o'clock sample omitted because of boil-off.

In Fig. 4 the oxygen consumed on the first set of samples show a peak at 11 a. m. corresponding to discharge of the silk boil-off. Another peak at 5.30 p. m. indicates discharge of a logwood bath which can be handled satisfactorily by coagulation. At other than these times oxygen consumed is under 200 p.p.m. with most values between 100 and 150. While this is not low, it is reasonably uniform and therefore treatment is much simplified. The oxygen consumed by the second set of samples, also shown in Fig. 4, shows two peaks at 1.30 and 2.30 p. m. running to just over 400 p.p.m. Other than these the values fall mainly between 100 and 150 p.p.m.

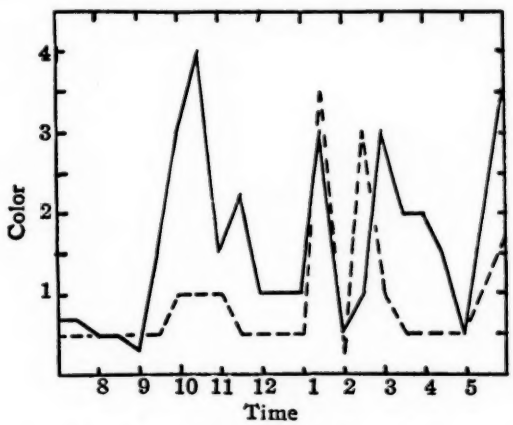


Fig. 2.—*Total Color in Lovibond Units Per 50.8 mm. Layer on Second Day's Samples.*

Original color in 1:9 dilution ——— solid line. Color after treatment of half-hour average (without dilution) — — — — dash line.

The maximum alkalinity to methyl orange, eliminating the boil-off, was 0.015 *N*, and the single acid sample was 0.026 *N*. The observations on the second day were started earlier in order to see if the affluent showed acidity for any considerable time, and on that day the effluent was not acid at any time.

Preliminary work had indicated treatment of this waste with five pounds of copperas and four pounds of lime per 1,000 gallons. The individual samples from the first set were precipitated in 50 c.c. portions and gave in four hours from 10 to 15 per cent of sludge by volume, varying in different samples. On standing twelve hours the sludge settled further to 5 or 6 per cent by volume. This indicated that the above treatment would give satisfactory results so far as the volume of sludge is concerned.

Averaging

Samples taken from the sump at half-hour intervals are each believed to represent a fair average for the preced-

ing half-hour. After treating these half-hour average samples the total color obtained from each is about one-tenth that of the original effluent, as shown in Figs. 1 and 2. In order to test out the advantage of taking a one-hour average, samples were made up to represent approximately such an average by mixing equal volumes of adjacent half-hour samples. On treatment these gave the third series of color values plotted in Fig. 1.

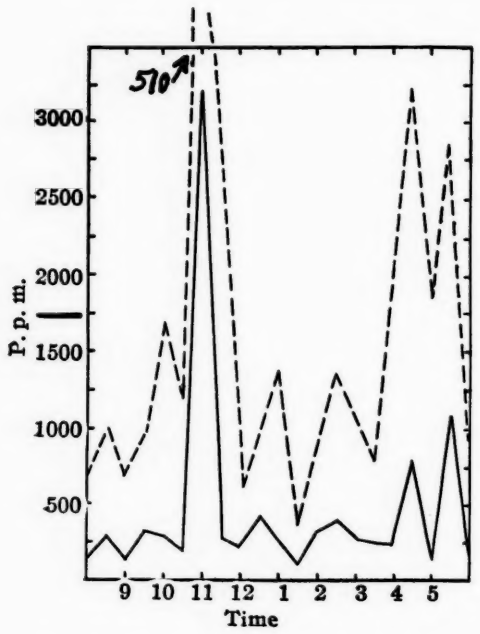


FIG. 3.—*Solids in First Set of Samples*

Total solids – – – – dash line. Loss on ignition ——— solid line

An effluent which gives a color reading under 5 is not objectionable after dilution in a fair-sized stream. Inspection of the graph indicates that the color of the treated effluent is mainly below this value, even for the half-hour average discharge. Striking exceptions are at 10 a. m. and in the late afternoon. The results of treatment of the half-hour average effluent show sharply defined ups and downs, as might be expected. Averaging these effluents over a period of one hour results in a much more uniform line, generally lying much lower. The more complete data, of which only a summary is given in Figs. 1 and 2, show that adjoining peaks are seldom of the same color. A given quantity of coagulant appears to remove about the same amount of each color from a mixture of several differently colored solutions as from each solution individually. We hope to test this observation quantitatively on some synthetically prepared wastes in the near future. The color of the treated hour-average waste from 1.30 to 4.30 was in general less than half that of the treated half-hour average. This illustrates the need for careful mixing of the wastes before treatment, a factor of great importance when the discharge from the plant is not homogeneous. With assumption of only a half-hour average the color of the second set of treated effluents is not over 5 units.

If, for a time, the plant is operating on a more highly colored waste, the amounts of copperas and lime fed can be temporarily increased. The chemical feeds should be oversize to allow for this contingency. It was concluded that the treatment could be expected to give acceptable results in operation with one hour averaging and four hours' settling.

Disposal of Miscellaneous Liquors Other Than Dye Liquors

The silk boil-off is rich in soap and is separately discharged to a tank in which it is made acid to methyl orange with sulphuric acid. The sludge of fatty acids and sericin which separates is skimmed and sold to a local plant, which works up such sludge for production of soap. Thus it furnishes a small source of revenue to offset the cost of chemicals and labor in the balance of the process. The silk-and-cotton boil-off is so badly contaminated that it should be diverted to the sewer along with the sludge. The hypochlorite bleach liquor is so small in quantity as to be diluted nearly one hundred times in the averaging basin. Experiment has shown that it can be handled by the treatment recommended for dyes. The peroxide bleach bath can be treated with the dye waste in the dilution in which it reaches the averaging basin. Mercerizing liquors occur only at long intervals, and the tentative method is to neutralize with sulphuric

(*Concluded on page* 109)

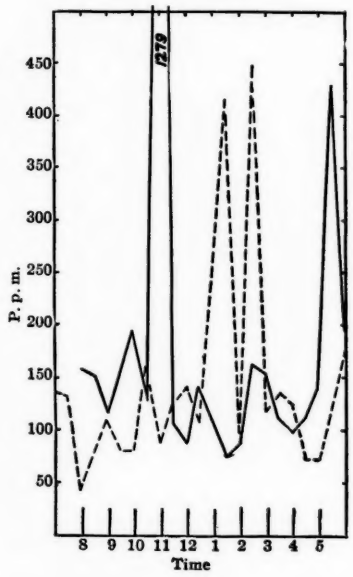


FIG. 4.—*Oxygen Consumed*

First day's samples ——— solid line. Second day's samples – – – – dash line. Value of 1279 is due to boil-off. 5.30 sample on second day, data lacking.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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JANUARY MEETING OF THE NORTHERN NEW ENGLAND SECTION

The second meeting of the Northern New England Section, A. A. T. C. C., for the season 1926-27, was held at the University Club, Boston, Mass., on January 22, 1927. About forty-five members and guests were in attendance. The meeting was characterized throughout by a spirit of keen interest and thorough enjoyment.

A brief business session followed the customary social period and dinner. At the business meeting it was voted to receive a written ballot-opinion from the entire membership of the Section as to the most favorable time for holding the meeting. This motion had been made by Alan A. Claflin, and was duly seconded. The ballots will be mailed with the notices of the next meeting. Announcement was made that Walter C. Durfee and Walter Haskell will be the speakers at the next meeting, which will probably be held on March 5. Mr. Durfee has for his subject, "Light and Color Vision, and a Classification of Color Effects." The paper promises some novel demonstrations, and will be both scientific and entertaining. Mr. Haskell will draw from his "Experiences With Naphthol Red AS."

At the conclusion of these announcements the speakers of the evening presented their papers, as follows:

1. Hugh Christison—"Interesting Experiences and Observations at the Southern Meeting."

2. Dr. H. C. Chapin—"Results of a Series of Experiments on the Relative Effects of Sodium and Potassium Compounds in Wool Scouring."

3. Leverett N. Putnam—"The Dyeing of Felt."

The papers were highly interesting and were greatly enjoyed, as was indicated by the live discussions that followed each.

The meeting adjourned to an informal gathering at 8.20 p. m., with a rising vote of thanks to the speakers.

A. K. JOHNSON, *Secretary.*

Interesting Experiences and Observations at the Southern Meeting

By HUGH CHRISTISON

In speaking of our annual meeting, I feel that everyone would be bored by any summary I might make of the papers read. The chairman should have known better than to ask for a report from me.

The only one important thing I can remember distinctly is that Professor Olney was not there. The affair seemed strange and unnatural without him. Another thing was a story one of the mill men told of one of his help. You know that many of the Southern mills are built in the country and have to provide houses for the workers to live in. The mill villages were quite a novelty to most of us, at least on so extensive a scale. This mill man had a mountaineer come to his plant to work and the man was shown the cottage he and his family were to occupy. He looked it all over but came back to a small room under the stairs which had a bathtub and other conveniences in it. The prospective employee shook his head and said, "I never yet lived or slept in

the same house with one of them things and I don't want to now."

Southern Mill Help

The help in the mills were a revelation to us. Colored people were almost absent, they doing only cleaning work and similar jobs. The average run of mill workers were the most intelligent and attractive we ever saw, and they certainly worked. The child labor story we of the North hear so much about proved entirely untrue. We simply didn't see any. The only person that could be called a child that I could find in visiting five mills said, on being asked what he worked at, "I am selling Red Cross seals." The overseers claim children are inefficient. The Southern mills appear to be successful because of the superior help and modern machinery and general arrangement, with long hours of labor. The one thing many of us asked is how long the good help supply will last.

The Southerners certainly lived up to their proverbial reputation for hospitality. We were given a turkey or chicken dinner every few hours. An exception was when we went to a hotel at Gaffney. Chicken, pork and steak were on the menu. Being fed up on chicken, I asked for steak. The gentleman at the same table observed that I must be a stranger. The accusation was admitted. He "reckoned" that probably I never had seen a Carolina cow and that I would regret my order. He was right.

The mills certainly opened their plants to us. Our Northern mills never approached in "openness" the reception we received at the Southern plants.

Going down, we traveled all night, and in the morning, on looking out of the car windows, we saw cotton fields with the plants loaded with cotton and the pickers working. The corn also was mostly unharvested on the stocks. We never expected to see this in December. The corn "licker," however, was a disappointment. To a Northerner the essential points of interest were the connected power plants covering hundreds of miles of area and making electricity for almost all the plants we saw, the well-trained help, the modern mechanical equipment, and the clayey water, making coagulation almost essential. The people are 99 per cent native born, very religious and rather wicked, and so adverse to unions that one of the largest mills was unable to give a community a $10,000 union church.

The awful anti-climax came when it was announced just before we went home that the full fare would have to be paid because the number buying railroad tickets was not as many as required to get the hoped-for reduction. The whole affair, however, was so well managed and worth while that we felt amply repaid for going.

Effect of Alkalies on Wool: II. Experiments Comparing Effects of Sodium Compounds, Potassium Compounds and Temperature*

By Dr. H. C. Chapin
Lowell Textile School

The compounds of potassium have long been preferred to those of sodium for scouring wool. The prevalent opinion of the industry is probably voiced by Knecht, Rawson and Lowenthal in their "Manual of Dyeing" when they say, "Experience shows that other things being equal a soda soap exerts a far more marked injurious action on wool than a potash soap"; further, that "The addition of sodium salts to a potash soap is irrational since a soda soap is thereby formed by double decomposition and the advantages which it is intended to gain by the use of the more expensive potash soap are thus to a large extent nullified."

The increasing margin in price between potassium and sodium compounds has led to substitution of the latter, both sodium soaps and soda ash, for scouring most wools. To some degree the disadvantages of this substitution have been offset by changes in the fats used for soap making. Can such modification of the sodium soap or in the manner of using soap and soda ash give results equivalent to those obtained with potassium soaps and potassium carbonate, or are there qualities inherent in the elements sodium and potassium themselves which forbid this possibility? Favoring the latter contention there is a common belief that because potassium compounds are provided by nature in the wool suint they are therefore the better for wool. The primary object of the research here described was to determine whether there is such a fundamental difference in action between sodium and potassium present as compounds in the wool scouring bath.

In the American Dyestuff Reporter, December 28, 1925, as contribution No. 1 of the Research Committee, American Association of Textile Chemists and Colorists, we presented results of experiments showing that, in some cases at least, pH rather than concentration or nature of alkali governs the effect of alkaline solutions on wool. We had used caustic soda and borax solutions at room temperature with the object of simple demonstration of the truth of the principle rather than its practical application. If these results have general significance then the carbonates of sodium and potassium, which in solutions of equimolecular concentration give about the same pH, should in such solutions have about the same effect on wool.

Though at first this hypothesis may appear contradic-

*Research Contribution No. 4. Research Committee of the American Association of Textile Chemists and Colorists. Presented before the Northern New England Section, January 22, 1927.

tory to the traditions cited, it is not necessarily so, because mill experience usually combines the effects of many factors, in this case the action of residual soap, alkali, glycerine, etc., in the dried goods, as well as the action of these substances in the bath. Study of each of these factors by itself is well nigh impossible in the mill, where absolute control of every influence is difficult at best, and where successful completion of the product must always take precedence over experiments in process.

While such factors as the influence of glycerine and other soap impurities or the difference in behavior of sodium and potassium compounds left in the wool after rinsing may well be made objects of future study, it has been the object of the research here described to stabilize or eliminate these other variables and study only the relative effects of sodium and potassium compounds in the bath at definite temperatures and concentrations.

Experimental

For this purpose we constructed a thermostat in which seven flasks containing wool and solutions could be held at the same temperature fixed within a small fraction of a degree. Twenty-eight skeins weighing about 3.2 grams each were prepared for one ball of naphtha extracted yarn similar to that used in our earlier investigation. As before, each skein was assembled from five smaller skeins taken from different parts of the ball. After assembling, all were rinsed uniformly with petroleum ether followed by water. The twenty-eight were then divided into four groups of seven each which we may designate 11 to 17, 21 to 27, 31 to 37, and 41 to 47. The first digit in each will then be the number of the group.

The same numbers will be used for the solutions in which these skeins were to be soaked. The solutions of group 1 were identical in composition with the corresponding members of group 2. The first in each case was distilled water, the second was 1/10 normal sodium, the third 2/10 normal sodium carbonate, the fourth 4/10 normal sodium carbonate, the fifth 1/10 normal potassium carbonate, the sixth 2/10 normal potassium carbonate, and the seventh 4/10 normal potassium carbonate. The members of groups 3 and 4 each contained ½ to 1 per cent of pure sodium olive oil soap. In other respects they were identical with the corresponding members of groups 1 and 2.

Of each solution 50 c.c. were used for rinsing the skein just before soaking and 450 c.c. for the soaking. Groups 1 and 3 were soaked at 47 degrees Cent., equivalent to 116.6 degrees Fahr., and groups 2 and 4 at 53 degrees Cent., equivalent to 127.4 degrees Fahr. In other respects, the manner of soaking was as nearly as possible identical for all four groups.

The seven stoppered flasks bearing the solutions of a group were immersed nearly to their tops in the water of the thermostat and brought to temperature. The skeins were then rinsed and immersed in their respective solutions. Soaking was continued for three hours, during which period at three different times each skein was stirred about slightly in its solution. At the end of the soaking period the skeins were removed, rinsed for an hour in running water and dried at room temperature. To avoid variations in soaking time the order in which the skeins were removed was made the same as the order of immersion.

The next step was to compare effects of solutions and temperatures upon the wool. Of course, the first practical evidence of damage is the surface harshness which becomes objectionable to an experienced observer long before weakening is evident. For this harshness there is unfortunately no definite method of measurement, but through the prolonged three-hour soaking period we hoped to produce weakening effects under various conditions which would follow the same order in magnitude as the harshening effects of the same series of conditions in the shorter time interval of practical scouring.

It was possible later to check the accuracy of this method by noting the previously well-known effects of alkali concentration and temperature in the same set of strength measurements which we used to prove the comparative action of sodium and potassium compounds. Finding known influences truthfully represented we could depend on finding the sought-for differences in action between the sodium and potassium compounds if such differences exist.

As shown in our earlier paper the harshness which accompanies weakness tends to hinder slipping of one fiber upon another in yarn under test, thus partially compensating for fiber weakness. This opposing effect we found could be avoided to some extent by wetting each strand

No.	Bath	Strength after soaking at 47°	Strength after soaking at 53°C.	Ph before	Ph after
11	water	177 grams			
12	.1 N. Na_2CO_3	150		11.01	10.89
13	.2 N.	143		11.13	11.02
14	.4 N.	143		11.21	11.10
15	.1 N. K_2CO_3	157		10.99	10.86
16	.2 N.	143		11.07	10.99
17	.4 N.	136		11.15	11.06
21	water		177		
22	.1 N. Na_2CO_3		145	11.01	10.85
23	.2 N.		132	11.13	10.98
24	.4 N.		125	11.21	11.05
25	.1 N. K_2CO_3		145	10.99	10.84
26	.2 N.		133	11.07	10.95
27	.4 N.		125	11.15	11.01

Table I

just before test; which practice we employed throughout the present work with the added advantage of avoiding changes in wool condition through fluctuations in atmospheric humidity. As before, specimens were mounted between grips 50 centimeters apart under initial tension of 50 grams, and pulled at the rate of 1 foot per minute.

Results

In Tables I and II each number under the heading of strength represents are average of seventy or more tests upon one of the composite skeins, in reality five skeins treated in one solution. The effect of temperature is plainly evident. Comparing corresponding members of

No.	Bath .5% soap in	Strength after soaking at 47° C.	Strength after soaking at 53° C.	Ph after
31	water	170 grams		
32	.1 N. Na_2CO_3	164		
33	.2 N.	154		
34	.4 N.	146		
35	.1 N. K_2CO_3	156		
36	.2 N.	151		
37	.4 N.	148		
41	water		167	
42	.1 N Na_2CO_3		146	10.76
43	.2 N.		141	10.87
44	.4 N		124	10.89
45	.1 N. K_2CO_3		149	10.82
46	.2 N.		142	10.87
47	.4 N.		136	10.88

Table II

groups 1 and 2 and of groups 3 and 4, we find the 53 degrees member to be the weaker in all fourteen comparisons, except the first, which is between skeins treated with water alone.

The effect of concentration is equally clear though smaller. In each group we may compare the action of 2/10 normal carbonate with that of 1/10 normal, and that of 4/10 normal with that of 2/10 normal. Sixteen comparisons are possible and in all but one the effect of higher concentration is apparent in lower strength.

The consistency of these figures with one another and with the known facts is remarkable in view of the small effects shown. The average loss for 6 degrees Cent. rise in temperature is 12 grams, and for each doubling of carbonate concentration but 8 grams. The strength of the original yarn soaked in cold water alone was 194 grams, so that these differences of 12 and 8 grams amount to but 6 per cent and 4 per cent respectively. With the two exceptions mentioned the smallest of the individual differences upon which we have based our averages are 5 grams temperature effect and 3 grams concentration effect, so that the figures would have been equally consistent for a temperature interval of less than 2 degrees Cent., or effect on strength of less than 2 per cent. The effect of carbonate concentration is strikingly small in comparison with that of temperature, 25 per cent increase in concentration being equivalent to 1 degree Cent. rise in temperature.

We may now proceed to a comparison of the two carbonates with assurance of finding evidence of difference in their action if there be any practical difference. In group 1, skein number 13 is equal in strength to number 16. The other two pairs of figures show the sodium carbonate skein to be the stronger in one case, the potassium carbonate skein just as much the stronger in the other. In group 2 there is virtual agreement between partners. The average effect of sodium carbonate is therefore identical with that of potassium carbonate in each group.

In the other two groups, treated with sodium soap as well as carbonates, we find four cases of agreement within 3 grams. In group 3 one other comparison shows greater effect from potassium carbonate and in group 4 one shows greater from sodium carbonate, so the average of group 3 favors potassium carbonate and that of group 4, sodium carbonate. Altogether, groups 3 and 4, as well as groups 1 and 2, reveal virtually no difference in action between the two carbonates.

What then is the effect of soap? The original strength of the yarn was measured by 280 tests on three composite skeins extracted like the others with petroleum ether but soaked in water alone at room temperature. These averaged 194 grams. Water at 47 and 53 degrees reduced the strength as shown in the first table to 177 grams, ½ per cent soap as shown in the second table to 168.5 grams, and 1/10 normal carbonates as shown in average of tests 12, 15, 22 and 25 to 149 grams. By subtraction we find the effect of heating the water to 50 degrees to be 17 grams, that of ½ per cent soap 8.5 grams, and that of carbonate in 1/10 normal solution (about ½ per cent in case of sodium), 28 grams.

To be sure, these figures do not carry quite the same weight as the averages previously quoted because they are based on smaller numbers of skeins and tests, but even after allowance for possible error they show the effect of sodium soap to be distinctly less than that of hot water or alkali carbonate. If potassium soap has any effect whatsoever, it cannot be far less than that of this sodium soap. So far as injurious action within the bath itself at a given temperature is concerned, we must, therefore, consider the two soaps practically equivalent, like the carbonates.

If there be differences they are in ease of rinsing, in subsequent action upon dried or drying wool, or in the temperature which may be employed for scouring or rinsing. It is well known that the potassium soaps and

carbonates are the more hygroscopic, and that potassium soaps are more likely to contain glycerine, also hygroscopic, as an impurity. It is probable that considerable amounts of these substances are carried from the scouring train by wool with consequent effect upon its condition for spinning. If this be true it may be more economical to add small amounts of potassium soap or glycerine to the last or next to the last bowl rather than to use potassium compounds exclusively in scouring.

Comparing sodium and potassium soaps made from the same fat we can see probable advantage for the potassium soap in the lower temperatures at which it will scour and at which it will rinse out; but this advantage may be gained through substitution of some other fat in soap manufacture as well as through substitution of potassium for sodium. There is also the possibility of rinsing more thoroughly by addition of such assistants as ammonia, which is sometimes used at the end of fulling and rinsing operations in finishing. These, of course, are but suggestions which require further study.

Contrasted with the mildly injurious action of soap by itself we find protective action from the same soap against the weakening effects of alkali carbonates. The average strength of the carbonate treated skeins of groups 3 and 4 is 7 grams greater than that of the corresponding skeins of groups 1 and 2, which had the same treatment except for the omission of soap.

The pH measurements were made electrically at room temperature of about 75 degrees Fahr. Hydrogen was supplied to the electrode directly from a tank of the compressed gas. This arrangement, with the same tank of gas, had given results on standard buffer solutions which agreed with accepted values within less than 1/10 of a unit.

Though recorded to the second decimal place, where there is some justification for comparisons, the figures in the tables are not presumably accurate in absolute value beyond the first decimal place. The carbonate solutions were prepared from ordinary analytical chemicals and boiled distilled water, and were adjusted to the desired concentrations on basis of titrations against the same standard acid. Their pH values are probably low compared with the best authorities in the literature, but they are as representative of ordinary scouring solutions as would be measurements on more carefully purified water and chemicals.

The pH values in the tables are notable chiefly for lack of pronounced differences. In our earlier work doubling of caustic soda concentration caused a rise of more than .3 in pH and consequent drop of 19 grams in wool strength. Here doubling carbonate concentration raises pH but 1/10 of a unit, so it is not surprising that the consequent drop in wool strength averages but 8 grams for each doubling of carbonate concentration.

In our earlier work the drop in pH through neutralization of caustic soda by wool averaged .4. Here the effect of wool on carbonate averages but .11 of a pH unit at 47 degrees and .14 at 53 degrees. The .03 greater drop at 53 degrees is plausible in view of the conversely greater effect of solution on wool at the higher temperature, but the difference in pH is unfortunately too small to be considered safely above the possible errors of measurement.

The slight buffer action of soap is evident in the .1 lower average of the few pH measurements on soap solutions compared with the average for the corresponding unsoaped solutions. The soap used was the best obtainable castile prepared for medicinal purposes. Like many textile soaps it doubtless contained excess fatty acid to prevent possibility of excess alkali. This would account for its buffer action, lowering the pH and injurious effect of carbonates. Excess of fatty acid would not necessarily prevent entirely the hydrolysis of soap to form traces of free alkali in water solution, hence the mildly injurious effect of soap by itself.

Similar behavior was shown in our earlier work by borax. Added to caustic soda solutions it reduced their injurious effects in proportion to reduction in pH, but alone, as we have found in a recent experiment, it has a slight injurious effect of its own. Possible buffer action of the soluble impurities of raw wool might be studied to advantage.

SUMMARY

Average strength of skeins soaked in water at room temperature - -	194.
" average of 47° & 53° C.	177.
soap sol'ns." " "	169.
carbonate sol'ns. at 47° - -	145.
" " 53°	134.
" & soap sol'ns. at 47° -	153.5
" " " 53°	139.5
" .1 N. with & without soap	151.
" .2 N. " " "	142.
" .4 N. " " "	135.
sol'ns. of Na_2CO_3 alone - -	139.5
" K_2CO_3 "	139.5
" Na_2CO_3 & soap - -	146.
" K_2CO_3 "	147.

TABLE III

CONCLUSIONS

1. The strength of wool has been measured before and after treatment with water, alkali carbonate solutions and soap solutions, in vicinity of 50 degrees Cent. or 122 degrees Fahr. In the results the effects of small changes in treatment are so apparent as to justify use of weakening effect as a measure of surface harshening effect.

provided only that there is some direct connection between the two.

2. In solutions of equal molecular concentration sodium carbonate and potassium carbonate have equal weakening effect.

3. The effect of sodium soap is small compared with that of the hot water in which it is dissolved, and much smaller than that of tenth normal sodium carbonate or potassium carbonate solution. If there be any difference in effect of sodium and potassium soaps it must therefore be trifling in comparison with other influences commonly present in the bath.

4. A soap which in water alone weakens wool may in solution with alkali carbonate reduce the weakening effect of the carbonate.

5. A rise of 1 degree Cent., or 2 degrees Fahr., in scouring temperature has about the same weakening effect on wool as a rise of 25 per cent in carbonate concentration, when the temperature is near 50 degrees Cent., and carbonate concentration near 2/10 normal.

6. For control of scouring bath alkalinity with delicacy equivalent to that of observation of effects on wool it would be necessary to measure pH with considerable care, to within a few hundredths of a unit; though rougher measurements might serve to indicate wide departure from desired conditions.

These conclusions apply only to action within the bath itself, not in the dried or drying wool. Suggestions are offered for improvement in condition for spinning without exclusive use of potassium compounds for scouring, and for better utilization of such beneficial effects as potassium compounds may confer. These will be made subjects of future study.

Discussion

Chairman Leitch—I think we will all agree that Dr. Chapin has presented information of considerable interest and value to wool manufacturers. This question of the relative values of sodium and potassium salts in wool scouring has been discussed by them for years. I believe that the thanks of the Section are due to Dr. Chapin for his careful work and for his kindness in presenting the results to us at this time. . . .

Mr. Grady asked what per cent of borax was necessary for protection of wool against caustic soda and was referred to Dr. Chapin's original paper in the AMERICAN DYESTUFF REPORTER of December 28, 1925. Dr. Chapin stated that borax lowers the pH of caustic solutions and that the question resolves itself into what pH any particular wool will stand.

Mr. Dalton asked the effect of ammonia in comparison with potassium carbonate. Dr. Chapin replied that because of its lower pH under scouring conditions an ammonia solution should have milder action, and that by forming a more soluble ammonium soap it should facilitate rinsing.

Dr. Stiegler asked the effect of naphtha extraction of wool grease upon yarn strength, to which Dr. Chapin replied that he had no data on this point and that it deserved investigation.

Dr. Stiegler then called attention to a paper entitled "Conditions Governing the Bleaching of Wool With Hydrogen Peroxide," published by Trotman and Trotman in the Journal of the Society of Dyers and Colourists, May, 1926. He was of the impression that these authors found no structural damage to wool heated in peroxide solutions of pH 10.

Dr. Chapin replied that this was surprising in view of the fact that these investigators heated their wool four hours at 55 degrees Cent. in solutions containing peroxide as well as alkali; but he stated that comparison of absolute values was dangerous because of probable difference in susceptibility of wools to injury by alkali. He said that the Trotmans worked on both chlorinated and unchlorinated wools, bleaching fabric in solutions of equal peroxide concentration, but of alkalinities varied from about pH 8 to nearly pH 13 through variation in sodium silicate concentration. In most cases the per cent of damaged fibers in the unchlorinated samples seemed to decrease in curious fashion with rising pH. The weight loss at the same time dropped to a minimum around pH 10 before rising with further increase in pH. This apparently was the basis for a claim of no structural damage up to pH 10. Dr. Chapin stated that these figures were contrary to his observation of continuous loss in strength with rise in pH, and that he did not see how peroxide or the nature of the original wool could alter the direction of this general trend.

Walter Durfee inquired why the Trotmans used silicate of soda, receiving the reply that they preferred it to other alkalies because of its supposed stabilizing action against decomposition of peroxide. Mr. Durfee then suggested that the peculiar results on structural damage might be due to some specific action of the silicate radical upon wool.

Mr. Ripley inquired how the Trotmans measured per cent by damaged fibers, receiving the reply that it was observed microscopically.

Prof. L. A. Olney stated that Dr. Chapin's work had been done under the auspices of the Research Committee of the Association and financed by the research fund.

Mr. Claflin directed attention to the great value of research, stating how much more wisely the million dollars' worth of potassium compounds used annually by New England wool scourers before the war might have been used in the light of information uncovered by this research at comparatively insignificant cost.

Proceedings of the American Association of Textile Chemists and Colorists

The Dyeing of Felt*

By Leverett N. Putnam

As felt is an isolated member of the textile family and its manufacture somewhat different, perhaps it would be well to go roughly over the fundamentals of its manufacture in order to have in mind a picture of felt when it is ready for dyeing.

The first part of its manufacture is very similar to that of wool. An order for a number of pieces is laid out in a batch; the different wools and shoddies are put through the picker. After blending, the batch is run through a set of breaker cards.

Here the process varies from the woolen mill in that the wool is doffed in the open web onto a drum. A bell attached rings when there is a certain weight of wool on this drum. The web is then broken and stripped from the drum.

After passing through the first set of cards it is then ready to be put onto the "former" cards which, in most instances, are two large cards (90 to 100 inches in width) setting at right angles. From the end of one card runs an endless apron of about 50 yards in length. This card throws its web directly onto the apron, while the other feeds at right angles onto the same apron by means of a folder. The speed is so regulated that while the folder is traveling across the apron the apron runs the width of the folder. For another type of felt this process is somewhat modified, the folder going twice this speed, making a trip over and back while the apron is traveling the width of the folder. This crossing and recrossing of the web over the straight web is comparable to the warp and filling. The "slow speed" or the "fast speed" is used, according to whether a firm, stiff felt or a limber, stretchy felt is wanted. Except for limited types, this is the usual method of forming all felts which are made in the piece.

Mechanical Process

After the apron has been around enough times to gain the necessary weight for the piece (generally six to eight times), it is trimmed, cut and rolled into a "batt," which is similar to the cotton batting you buy at the store. It now goes to the "platting" or "hardening" process, where two new are put with two first run batts. These batts are laid alternately between damp duck aprons. The process consists of steaming by moist steam until the fibers are warm and damp, then passing through a weighted platter which has a rather fast vibrating motion covering a short distance sideways. This presses and tangles the fibers together, thinning the batt from 2 inches in thickness to ¼-inch or less.

If the wools are not blended properly they will aggregate themselves into short or long fibers, or if there is an excessive amount of short fibers used, these will group themselves into little balls which will mat and unite together. Every precaution is taken to keep the mass as uniform as possible so that on looking through it, the individual collections of fibers can be seen as little as possible.

After two runs on this machine the felt has now tensile strength enough to be handled, but not enough to stand a rotary fulling mill. They are therefore soaped and put into a kicker fulling mill, run a few minutes, then taken out and laced or overhauled. As the wool is so loose and active this has to be done at the proper time, otherwise felting together and crow feet would be the result. Each run in the fulling mill can be of longer duration, however.

When the proper length and width has been attained, the goods are strong enough again to handle as a piece of woolen or worsted would be handled. They now go to the washing machine, are scoured, and are then ready for the dyehouse.

I have taken considerable pains to try to make the construction as plain as possible for those to whom it is not familiar in order that they may see why, during the dyeing, felt cannot be handled roughly. There are numerous factors which enter into the whole process preliminary to dyeing which are of vital importance. If the wools are not properly blended, the felt pills, consequently losing its tensile strength. If the hardening is not done properly, it will spoil any properly bleached batch. If the goods are not properly soaped up in time in the fulling, it also upsets the piece; if not spoiled, pulling out in the dye kettle is sure to result. All these things seriously handicap the dyehouse.

Dyeing Process

Taken as a whole, the dyeing of felt may be considered a piece dyeing proposition, using mostly acid and union dyes. There are many Oxfords and other types of mixtures made, but advantage is taken of dyed shoddies and most of the colored stocks are the shoddy.

Of the straight acid dyed felts for consideration are the better grades of pennant felt, slipper felt, ladies' hat felt, the felt used on Victrola bases under the records, telephone bases, piano felts, trimmings of all descriptions, etc. These felts vary greatly in their uses and have to be dyed to stand the requirements of their use. Piano felts are frequently colored, but they rarely see daylight, so, consequently, can be dyed with almost anything. Hat felt, on the other hand, has to be dyed fast to light. Shoe felt is quite thick and dense. Care must be taken to get the proper penetration.

*A paper presented before the Northern New England Section of the American Association of Textile Chemists and Colorists, January 22, 1927.

Still other types of felt are so dense when finished that they cannot be dyed when completely finished. Such felts are acid fulled pieces. These pieces have to be fulled in soap as far as practical, taken out, washed, dyed and acid fulled. Of course, here precautions are taken to choose colors which will stand acid fulling.

Some of the difficulties experienced in acid dyeing are: Making solid shades on the colored shoddies (which are nearly always present wherever possible, because colored shoddies are cheaper); dyeing the piece properly before it begins to lose its tensile strength, and, on some of the thicker felts, getting the proper penetration.

Cotton Mixtures

Where cotton is used one way is to feed the former cards in such manner that the bulk of the cotton is made in the center of the piece, with a fairly heavy all-wool face and a single run-wool back. Such fabrics are made chiefly into thick felts, as shoe and slipper felts. Other cotton-mix felts are solid mixtures. This type of felt is used in many ways, from the cheapest, flimsiest stuff containing only about 15 to 20 per cent wool to those containing 80 per cent or more. These union felts are always colored solid shades using direct dyes without aftertreatment.

On cotton mixed fabrics which are dyed solid shades, considerable care must be exercised to have the cotton and wool dyed the same shade. This is often very difficult because of the colored shoddy. Some felts run as high as 35 per cent shoddy. Shoddy comes as a rule in black or red colors. The red is apparently colored from light shade rags, since the dye may be largely stripped with ammonia before starting to redye. The cotton is always white and in many cases the wool is deeply colored to start. This means that there can be very little boiling, or your wool will be heavy. Very often advantage is taken of the fact that the bulk of the cotton is in the center of the piece and the dyer is called upon to imitate acid-dyed felts of bright, clear shades. This can be done by the use of bright neutral-dyeing wool colors. It is often the case that the dyer will have so much wool color present, he can only come to the boil and then shut off his steam and let the rest pick up as the goods run back. On this wool-faced union, instead of using cotton, flax noils are substituted to give the felt a firmer handle. These are rather hard to penetrate and have poor dyeing qualities, consequently great care has to be taken or the fabric will show white or light when cut.

Matching

The same holds true on cotton-mixed felts as all-wool felts. The lighter lines are not overstrong and will soon creep, causing pilling and thus making a poor piece of goods. The work must leave the dyehouse just as soon as it is possible for the good of all concerned. There are some lines which are not required to be absolute matches, but must have to be held just as close as any requirements in a woolen or worsted mill. Even a great many of the cheaper felts are used for trimming and filling where the same shade on a more expensive felt has been used, and so must match.

One feature in connection with dyeing some cotton-mixed blacks is the uncommon method of dyeing used. It is known as the one-dip Logwood Black. Felt thus dyed is used in the shoe trade for box toe stiffeners of one description or another and even in shoe felt. In this case the dyeing process adds a little weight and gives a firm crisp handle which is very desirable when wanted. It is done by using a standing bath made up of unoxidized logwood, blue stone and soda ash. It resembles ordinary speck dye except that the soda ash is very much less in proportion and the dyeing takes place at the boil. The goods are boiled to shade, taken out when a deep jet black, and scoured to remove crock. Goods dyed by this method have a full crisp handle and the felt holds its shape well.

Another feature of interest is the difference in behavior of wool when dyed in acid or neutral bath. If dyed in acid the wool preserves its elasticity and stretches to normal finish width. When a like piece is dyed in neutral bath the wool loses its elasticity so much that the felt often breaks on the drier. The dyed wool can be stripped in alkaline bath if carefully done and no harm result.

Still another inexplicable fact is illustrated when, in dyeing regular Acid Black with the use of acetic acid, the piece will lose two or three yards in length, more than is lost with any other shade. When an order for black came through, the finishers left this amount of extra yardage in the piece so that the goods would finish to measure when colored.

There are other minor types of dyeing used in dyeing felt. They are perhaps of minor importance, but they are not always easy. It is quite the fashion to imitate, and this is not forgotten with felt. Many bright shades are used, and for the best work are dyed on white all-wool felt. Somebody will want something cheaper and can use what he gets, so he buys a cotton-mixed felt. As the shade can't be made bright enough by union dyeing, the wool is dyed and the cotton tanned, antimonied and dyed with basic colors. Of course, this style crocks somewhat, but the brightness is there. Another method even cheaper and generally on nearly all cotton felt, are these same shades imitated by union dyeing and then topping directly with basic colors. Some pretty results can be obtained by this method, and where the results are satisfactory it is worth while.

Still another minor branch of dyeing felt is that on which a ground color is dyed and the piece is printed afterwards. This means that colors have to be selected which can be discharged if necessary.

Ordinarily the finishing consists only of shearing and pressing, so that is not very difficult. However, there are exceptions. There are certain felts that have to be sanded and have a fancy finish.

Felt is an interesting subject. Unless you know some of its uses you would scarcely realize how many different ways it can be employed. As you go about, take notice how many times you see a piece of felt, and how many different types you see. I am certain that you will be surprised. I have mentioned some, but there are infinitely many more.

Gentlemen, I thank you for your attention, and will be pleased to answer any question that I can pertaining to the coloring of felt.

Discussion

Chairman Leitch—I wish to thank Mr. Putnam for his kindness in preparing and presenting this paper. I hope there will be questions asked, which are in order at this time. . . .

Mr. Grady asked why certain piano felts, dyed scarlet, showed white centers. Mr. Putnam replied that this was often the case with this type of piano felt, but that he did not know of any technical reason why it should be so.

Mr. Grady said that the felt could be dyed evenly with Cochineal Scarlet, but that the trade did not seem to want the centers dyed. Mr. Putnam ventured the suggestion that perhaps in the early days of the industry it was impossible to get the penetration, and the use of unpenetrated felt had now become an established custom.

Mr. Grady inquired if the formation of the felt was carried out on the card. To this the speaker replied that the weight, and, to some extent the width, of the felt were determined on the cards, the remainder of the formation being accomplished by the hardening and fulling processes. About the same weight of warp and filling were used in the felt.

Mr. Grady wanted to know if silk and rayon could be run on the same cards. The answer was in the affirmative. Advantage of this is taken in making union material, as in felt with wool on face and back and cotton centers. The quantity of wool could be varied on either face or back to give a scrimpy quantity or a solid wool face. If the cards had been running on cotton, wool could be run onto the cards without cleaning the card. The cotton could subsequently be dyed or left undyed as the case required. An example of a felt with undyed cotton was given as the former type of Victrola felt (open disc type), which felt had a wool face and white cotton back.

Mr. Durfee asked if there were any interesting drying, processing or handling problems, which differed from those in other woolen industries. Mr. Putnam said that after the formation and washing of the felt from the fulling mill, it would stand anything which loosely woven woolen cloth would stand. The largest stress was to be laid upon proper blending, the formation to insure uniformity, and the hardening. The webb, known as bat, is placed on a canvas apron laid on a long table; then covered with a piece of duck canvas and sprinkled with a hose. Several other layers, it may be of variable thickness, are laid over the first in a similar manner. The whole then approaches the steam box and is steamed. It then encounters the plattin plate, where it is subjected to the rapid, oscillating motion of the platter. This is of steel or iron, weighs about a ton, and moves over a short distance. If the mass of bats and canvas begin to roll under the platter a ropy condition will result. Under normal conditions strength and firmness are added to the felt. This hardening process is simple but exacting, requiring proper conditions of moisture heat, motion from the platter and thickness of cushion.

Mr. Grady inquired if hat felt was acid hardened. The answer was that men's felt hats were so hardened, though made somewhat differently by use of a form. Women's felt hats are often made in the piece, stamped out, and finished on a form.

Mr. Spurr described the making of hats from fur, where in the first process the wet fur is blown onto cones, then the pieces are dipped and rolled with a roller on a board, this process being repeated several times. They are then formed, shaped and shellacked on the inside.

Mr. Putnam spoke of the great numbers and varieties of felts, using the piano as an illustration of an article wherein many kinds of felt find use. Specific attention was called to the hammer felts, made in such different weights and shapes.

Dr. Stiegler asked about the strictness of specifications for piano felts and was told that they were very strict, special attention being given to the elasticity and resiliency of the hammer felts. This property affects the rebound from contact with the wires.

Mr. Spurr suggested that for the hammer felts good wool would have to be used, as shoddy would kill the resiliency.

Dr. Chapin asked if piano felts were now mothproofed. Mr. Putnam did not know, but Mr. Brandy said they were.

In connection with the shortening of felt dyed with acetic acid, Dr. Stiegler desired to know if there were any changes of conditions of dyeing over those used for other acid colors. Mr. Putnam said that the only change was the use of acetic acid to start the dyeing and of vitriol to complete the process. Ordinary acid dyes, say

on pennant felt, left about 45 yards to the piece, whereas the Acid Black left about 43 yards, the difference being allowed for by the finisher in the preparation of the felt for dyeing blacks.

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Changes of Address

Arnold, Henry D., National Aniline & Chemical Company, 40 Rector Street, New York City.

Blair, James A., Jewett City, Conn.

Blake, K. B., care of Allerton House, 143 East Thirty-ninth Street, New York City.

Brown, G. Arthur, Box 34, Richelieu Village, P. Q., Canada.

Dick, J. B., 29 Julian Street, Norwich, Conn.

Govier, G. Van Tromp, A. E. Staley Manufacturing Company, Botolph House 10, Eastcheap, London, England.

Guiterman, Edward W., 337 Aycrigg Avenue, Passaic, N. J.

Kimble, F. M., care of Clifton Hotel, Carrollton, Ga.

Kingman, Wm. A., care of Lowe Paper Company, Ridgefield, N. J.

Lagazio, Julius, J. G. Rutherford & Co., 625 Hudson Street, New York City.

Newman, Douglas C., 232 West First Street, Charlotte, N. C.

Seery, Francis T., 157 Hudson Avenue, Chatham, N. Y.

Sheldon, Irving L., Jr., care of I. C. Wordell, 11 Florence Avenue, Brookline, Mass.

Wang, Chen, Kiangyin, Kiangsu, China.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

WALTER E. HADLEY,
5 Mountain Avenue,
Maplewood, N. J.

Summary of Dyestuff Imports for 1926

With List of Dyes Imported Through New York and Other Ports During December

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS OF MANUFACTURERS' NAMES

1—THE SIX LEADING GERMAN COMPANIES

IG—Interessen-Gemeinschaft der Farbenindustrie.
A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873.
B—Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By—Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862
C—Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K—Kalle & Co., A. G., Biebrich-on-the-Rhine. Founded 1870.
M—Farbwerke, vormals Meister Lucius & Bruning, Hochst-on-the Main. Founded 1862.

2—THE SMALLER GERMAN COMPANIES

BK—Leipziger Anilinfabrik Boyer & Kegel, Furstenberg, near Leipzig. Founded 1882.
CG—Chemikaliewerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1882.
CJ—Carl Jager G. m. b. H., Anilinfarbenfabrik, Dusseldorf. Founded 1823
GrE—Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L—Farbwerk Mulheim, vormals A. Leonhardt & Co., Mulheim-on-the-Main. Founded 1879
Seig.—G. Seigle Corporation, Stuttgart.
tM—Chemische Fabriken, vormals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—SWISS COMPANIES (ALL AT BASEL)

DH—Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G—Anilinfarben-und Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I—Gesellschaft fur chemische Industrie. Founded 1885.
S—Chemische Fabrik, vormals Sandoz & Co. Founded 1887

4—DUTCH AND FRENCH COMPANIES

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888
NF—Niederlandische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
CN—Compagnie Nationale de Matieres Colorantes et Produits Chimiques. Founded 1917. (Etablissements Kuhlmann merged with this company in 1923.)
P—Societe Anonyme des Matieres Colorantes et Produits Chimiques St. Denis (formerly A. Poirrier). Founded 1830.

5—ENGLISH COMPANIES

Bro—Brotherton & Co., Ltd., City Chambers, Leeds.
BAC—British Alizarine Co., Ltd., Manchester
BD—British Dyestuffs Corporation, Ltd., London.
Cl Co.—The Clayton Aniline Co., Ltd., Clayton, Manchester.
CV—The Colne Vale Dye & Chemical Co., Ltd., Milnsbridge, Huddersfield.
Hol—L. B. Holliday & Co., Ltd., Huddersfield.
Scot—Scottish Dyes, Ltd., Grangemouth.

SUMMARY OF DYE IMPORTS FOR 1926

THE imports of coal-tar dyes during 1926 (preliminary figures) were 4,615,551 pounds, with an invoice value of $4,083,468. This represents a decrease of 594,050 pounds, or 11 per cent, and of $553,772, or 12 per cent, less than that of 1925.

Table No. 1 shows the imports of coal-tar dyes for 1926 and for the years 1920 to 1925, together with the imports for the fiscal year 1914. The quantity for the year 1914 was taken from the Department of Commerce's Special Agent Series 121, and the value from Commerce and Navigation. The figures for the years 1920 to 1925, inclusive, were taken from the Annual Census of Dyes and Other Synthetic Organic Chemicals, published by the United States Tariff Commission. The final figures for the dye imports of 1926 will be published in the Census of Dyes and Other Synthetic Organic Chemicals for that year.

Table No. 2 shows the imports of coal-tar chemicals and color lakes for 1926.

Table No. 3 shows the percentage of each class of dyes by application of the total dyes imported. The vat dyes percentage declined for 1926 as compared with 1925; the total imports were about 1,850,000 pounds, as against 2,418,842 pounds in 1925; while the percentage for acid dyes recorded an increase. The percentages of the total imports for other classes in 1926 recorded a relatively small change as compared with those of 1925.

Table No. 4 shows the dyes of each class according to the method of application imported in the largest quantity during 1926, together with the imports during the years 1925 and 1924. The 106 dyes contained in this table comprise 64 per cent of the imports during 1926.

TABLE NO. 1

Coal-Tar Dyes Imported

Year	Pounds	Value	Year	Pounds	Value
1926*	4,615,551	$4,083,468	1922	3,982,631	$5,243,257
1925	5,209,601	4,637,240	1921	4,252,911	5,156,779
1924	3,022,539	2,908,778	1920	3,402,582	5,763,437
1923	3,098,193	3,151,363	1914	45,950,895	9,502,714

*Preliminary figures.

TABLE NO. 2
Coal-Tar Chemicals Imported—1926

	Pounds	Value
Synthetic aromatic chemicals	154,711	$190,270
Medicinals, photographic developers, intermediate and other coal-tar chemicals	1,537,102	681,134
Color lakes	20,722	13,637

TABLE NO. 3
Dyes Imported into the United States—1924 to 1926

(Percentage of each class by application)

Class of Dyes	Per Cent of Total 1926*	1925	1924
Acid dyes	16.99	11.32	17.56
Vat dyes	39.46	46.43	38.98
Mordant and chrome dyes	10.77	12.33	14.63
Direct dyes	17.28	14.57	17.01
Basic dyes	8.78	11.66	6.81
Sulphur dyes	3.12	2.35	3.68
Color-lake and spirit-soluble dyes	1.80	1.10	0.75
Other dyes	1.80	0.24	0.58
	100.00	100.00	100.00

*Preliminary.

TABLE NO. 4
Dyes of Each Class, According to Method of Application, Imported in Largest Quantity During the Calendar Year 1926 (preliminary figures), Compared with Imports in 1925 and 1924

Col. Ind. No.	Sch. No.	Class and Name of Dye	1926	1925	1924
		ACID DYES			
671	506	Erioglaucine	71,502	35,295	28,655
—	—	Indocyanine B	51,295	16,521	(*)
1054	858	Alizarine Saphirol B	41,945	30,425	40,600
714	545	Patent Blue A	29,899	31,097	10,715
833	—	Wool Fast Blue BL, GL	29,468	30,248	4,940
430	—	Polar Red	25,813	28,584	7,756
691	523	Fast Green	23,993	18,967	30,721
—	—	Brilliant Milling Blue	19,308	8,400	6,200
735	564	Naphthalene Green	18,539	15,299	4,357
712	543	Patent Blue V	16,196	24,892	23,606
—	—	Neolan Blue	16,090	8,813	220
667	503	Erioviridine B	14,867	13,946	4,796
—	—	Neolan Pink	14,548	1,100	.....
715	546	Cyanol	13,614	8,995	3,688
1091	—	Alizarine Rubinol	12,940	7,734	11,514
288	257	Sulphoncyanine G	12,582	3,264	100
1053	—	Alizarine Saphirol SE	12,497	24,382	(†)
—	—	Neolan Yellow	12,235	1,872	.....
—	—	Alizarine Supra Blue	11,188	2,000	(‡)
307	265	Acid Milling Black B	11,022	17,635	9,484
—	—	Polar Orange	11,021	13,386	2,204
487	400	Acid Milling Red R	10,911	7,800	3,002
—	—	Supramine Red	10,200	3,034	1,188
		VAT DYES			
1228	907	Ciba Scarlet	142,485	123,473	40,200
1113	842	Indanthrene Blue GCD	133,832	139,876	68,450
1229	908	Ciba Red R	111,320	85,084	17,635
1212	918	Indanthrene Red Violet RH	109,244	69,107	29,038
—	—	Helindone Printing Black RD	75,000	68,000	8,300
1184	881	Brilliant Indigo 4B	65,711	92,300	5,783
1118	849	Indanthrene Yellow GR	63,346	111,713	39,771
1096	760	Indanthrene Golden Orange G	58,334	46,646	76,046
1222	901	Ciba Violet B, R	55,559	276,858	82,598
1150	833	Indanthrene Olive R	55,221	22,772	30,665
1097	761	Indanthrene Golden Orange R	53,826	90,730	112,339
1152	—	Indanthrene Brown G	53,004	51,813	18,155
1095	759	Anthraflavone GC	41,002	73,816	35,936
1151	—	Indanthrene Brown R	37,111	59,033	71,313
1176	795	Cibanone Yellow R	34,830	34,815	21,035
1190	885	Brilliant Indigo B Paste	32,920	12,455	11,218
—	—	Indanthrene Pink B	32,548	27,429	39,131
1099	763	Indanthrene Dark Blue BO	27,932	27,961	2,943
—	—	Ciba Pink BG	27,326	22,971	21,653
—	—	Hydron Brown G, R	23,690	36,076	42,681
1104	767	Indanthrene Violet RR	22,927	21,736	19,027
1217	913	Helindone Orange R	22,740	63,608	37,077
		MORDANT AND CHROME DYES			
1027	778	Alizarine (synthetic)	86,606	75,174	42,695
1088	855	Alizarine Sky Blue B	31,612	34,352	20,729
1037	783	Purpurine	19,948	28,281	271
720	551	Eriochrome Azurol B	19,886	28,093	12,664
894	637	Gallamine Blue	18,287	36,021	.....
1084	854	Alizarine Viridine FF	17,634	21,798	5,778
1063	790	Anthracene Bllue	16,294	500	1,493
—	—	Metachrome Blue Black	15,353	15,000	9,500
—	—	Acid Anthracene Brown	13,295	5,515	(*)
1078	865	Alizarine Cyanine Green	11,105	11,276	7,636
1034	780	Alizarine Red S	11,009	14,402	3,611
—	—	Alizarine Light Gray BS	10,998	9,503	.....
—	—	Eriochrome Blue Black	9,921	2,204	(†)
878	622	Delphine Blue B	9,903	3,481	5,597
—	—	Acid Alizarine Gray G	8,875	8,705	7,025
1040	784	Alizarine SX	8,580	12,506	11,773
1064	—	Alizarine Cyclamine R	8,372	15	796
892	635	Modern Violet	8,315	7,983	1,925
1067	804	Alizarine Blue S	7,180	16,359	8,152
1085	862	Alizarine Blue Black	7,147	51,066	78,195
		DIRECT DYES			
—	—	Chlorantine Fast Blue	38,242	28,435	17,268
—	—	Chlorantine Fast Violet	37,576	33,941	4,849
382	319	Diamine Scarlet 3B	34,599	16,899	3,550
316	273	Diaminogene Blue	28,395	31,943	23,970
—	—	Diazo Sky Blue	22,599	2,776	4,785
—	—	Brilliant Sky Blue	20,939	22,961	4,735
436	358	Chlorantine Red 8BN	20,655	28,631	11,608
—	—	Diaminogene Blue GG	20,051	11,933	.....
561	449	Trisulphon Brown B	18,509	25,815	24,020
—	—	Diazo Brilliant Green 3G	17,935	10,521	5,132
—	—	Benzo Fast Brown	17,496	9,004	5,976
—	—	Chlorantine Fast Brown	14,550	34,268	30,202
70	—	Rapid Fast Red GL	14,500	(*)	(*)
628	206	Diphenyl Catechine G	13,227	8,817	4,250
—	—	Diamine Fast Orange	11,938	12,000	11,763
409	339	Diamine Orange B	11,863	9,201	11,300
317	274	Diaminogene B	11,108	2,108	13,951
577	457	Trisulpho n Brown 2G	11,015	10,007	14,754
—	—	Zambesi Black	10,825	8,380	7,913
631	14	Diphenyl Chrysoine GC	9,336	3,857	.....
		BASIC DYES			
749	573	Rhodamine B	133,945	228,105	97,254
—	—	Rhodamine 6GDN	*61,050	*75,700	(†)
924	660	Methylene Green	21,328	20,045	100
797	608	Euchrysine	18,080	15,622	4,525
729	559	Victoria Blue B	18,057	13,389	4,533

*Included in Schultz No. 88. †Included in Schultz No. 180.

*Included in Indamine 6R. †Included in Schultz No. 858. ‡Included in Alizarine Direct Blue.

*Separate figures not obtainable.

TABLE NO. 4—(Continued)

Col. Ind. No.	Sch. No.	Class and Name of Dye	1926	1925	1924
789	—	Patent Phosphine	17,743	9,142	(‡)
788	603	Acridine Orange	15,621	17,353	4,031
677	512	Magenta	12,755	2,360	355
793	606	Phosphine	10,250	27,760	24,300
680	515	Methyl Violet	9,436	250	703
796	538	Methyl Lyons Blue	7,716	10,882	.....
851	690	Diphene Blue R	7,341	4,331	2,500
926	661	Thionine Blue GO	6,841	6,124	1,306
927	663	New Methylene Blue	6,300	8,200	3,245
658	496	Setoglaucine	5,650	5,741	3,867
		SULPHUR DYES			
—	—	Cross Dye Green B, G	41,246	57,924	35,246
—	—	Thionol Green	37,957	.....	.....
—	—	Thionol Brown	16,985	18,383	16,060
—	—	Thionol Yellow	10,960	4,970	.....
—	—	Indocarbon	9,950	50	.....
—	—	Pyrogene Green GK	5,511	4,408	(*)

*Single-strength basis. †Included in Schultz No. 571. ‡Included in Schultz No. 606.

*Included in Schultz No. 746.

DYES IMPORTED IN DECEMBER, 1926

COAL-TAR dyes imported through New York and other ports during the month of December, 1926, totaled 331,812 pounds, with an invoice value of $266,042. Imports by ports were as follows: New York, 284,330 pounds, valued at $220,758; Boston, 23,692 pounds, valued at $25,223; Albany, 23,690 pounds, valued at $19,961, and Chicago, 100 pounds, valued at $100.

Imports of Synthetic Dyes—1926

	Pounds	Invoice Value
January	190,459	$184,018
February	479,027	477,255
March	487,804	435,891
April	437,526	401,606
May	392,739	343,745
June	333,319	317,896
July	351,425	303,079
August	380,414	298,159
September	387,533	322,446
October	460,351	406,167
November	383,142	327,164
December	331,812	266,042
Total 12 months	4,615,551	$4,083,468

Five Leading Dyes, by Quantity, Imported During December, 1926

	Pounds
Brilliant Indigo 4B Paste	16,122
Thionol Green B	14,991
Rhodamine B (single strength)	13,300
Purpurine	11,103
Ciba Red 3B Paste	10,509

Dyes and Intermediates Remaining in Bonded Customs Warehouse

	Dyes and Colors (pounds)	Intermediates (pounds)
June 30, 1926	671,396	772,475
July 31, 1926	512,186	781,796
August 31, 1926	557,852	690,031
September 30, 1926	395,535	590,520
October 31, 1926	281,320	557,257
November 30, 1926	303,321	539,561

Per Cent of Dyes by Country of Shipment

	1926		
	Dec.	Nov.	Oct.
Germany	58	50	48
Switzerland	20	28	30
France	2	4	6
England	8	4	5
Belgium	4	7	4
Canada	4	5	5
Italy	4	2	2

The dyes in this report are grouped by both Colour Index and Schultz numbers, and, in the case of those which could not be identified by either number, the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single-strength basis.

DYES OF COAL-TAR ORIGIN

Colour Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
10	7	Naphthol Yellow SXX—(IG)	20
16	137	Fast Yellow S—(IG)	300
70	—	Rapid Fast Red GL Paste—(IG)	5,000
114	94	Guinea Fast Red 2R—(IG)	500
127	118	Brilliant Geranine B—(By)	200
134	125	Black JI (Janus Black I)—(IG)	100
145	140	Jasmine High Conc.—(G)	1,102
151	145	Orange IIP—(IG)	20
175	—	Metachrome Violet B—(IG)	700
256	230	Cloth Red 3G Extra—(IG)	25
257	231	Cloth Red 3B Extra—(IG)	25
278	—	Chlorazol Fast Red K—(BD)	300
307	265	Acid Milling Black B—(G)	2,204
316	273	Diazamine Blue BR Conc.—(S)	765
319	—	Direct Fast Heliotrope BL, 2RL—(By)	1,670
324	—	Diazo Brilliant Scarlet ROA Extra—(IG)	500
326	279	Benzo Fast Scarlet 8BS—(IG)	200
332	284	Vesuvine B Conc.—(IG)	5
346	296	Benzo Fast Yellow 5GL—(IG)	100
349	—	Chlorantine Fast Yellow 4GL—(I)	382
382	319	Chloramine Red B—(S)	
		Universal Bordeaux C—(IG)	2,373
394	327	Universal Violet C—(IG)	50
403	—	Diphenyl Fast Gray BC—(G)	331
409	339	Diamine Orange B—(IG)	1,000
420	344	Universal Dark Brown C—(IG)	25
423	349	Universal Olive Brown C—(IG)	25

Colour Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
430	—	Polar Red G Conc., RS Conc.—(G)	3,306
436	358	Chloramine Red 8BS—(By)	
		Diazol Fast Purpurine N8B—(CN)	1,051
440	360	Ignamine Orange R—(IG)	500
443	—	Acid Anthracene Red G—(IG)	100
448	363	Universal Scarlet C—(IG)	50
449	364	Diazo Brilliant Black B—(IG)	1,014
487	400	Acid Anthracene Red 3B—(IG)	
		Acid Milling Red R Conc.—(G)	
		Brilliant Milling Red R—(IG)	2,904
508	415	Universal Light Blue C—(IG)	100
516	423	Universal Steel Blue C—(IG)	
		Blue NBB—(IG)	1,075
561	449	Trisulfon Brown B Conc.—(S)	2,000
578	459	Universal Dark Blue C—(IG)	300
590	471	Polyphenyl Blue GC—(G)	1,102
636	19	Fast Light Yellow 3G—(IG)	340
639	22	Supra Light Yellow 2GL—(IG)	772
653	—	Direct Fast Orange K—(I)	1,102
654	—	Diazo Fast Yellow 2G—(By)	220
662	499	Brilliant Green Powder Conc.—(IG)	20
677	512	Fuchsine N—(Q)	35
686	515	Methyl Violet—(St.D)	
		Methyl Violet 4B—(IG)	
		Violet for Ink Pencils—(IG)	455
681	516	Crystal Violet Crystals—(IG)	
		Crystal Violet Extra Powder—(IG)	560
691	523	Fast Green Extra Bluish Conc.—(IG)	2,630
692	524	Magenta S—(IG)	100
704	536	Alkali Blue 4R—(IG)	250
707	539	Opal Blue Bluish—(IG)	50
712	543	Patent Blue V—(IG)	1,000
714	545	Brilliant Acid Blue A—(IG)	
		Patent Blue A—(M)	
		Poseidon Blue BR Conc.—(IG)	
		Poseidon Blue BR Extra—(IG)	5,051
715	546	Blue Extra—(C)	
		Cyanol Extra Powder—(C)	
		Xylene Cyanol FF Conc.—(S)	722
724	555	Aurine—(Lo)	336
728	558	Victoria Blue R Base—(I)	331
735	564	Erio Green B Supra—(G)	
		Naphthalene Green Conc.—(IG)	
		Poseidon Green VGGX—(IG)	1,802
748	579	Sulpho Rhodamine B Extra—(IG)	200
749	573	Rhodamine B Extra (s. s.)—(IG)	
		Rhodamine B Extra (s. s.)—(Q)	13,300
752	571	Rhodamine 6G Extra (s. s.)—(IG)	2,500
758	582	Acid Violet 4RA Conc.—(IG)	200
760	584	Violamine 3B—(IG)	50
762	—	Chromorhodine BN—(DH)	441
786	—	Auracine G—(IG)	25
789	—	Patent Phosphine G, R—(I)	1,102
801	613	Quinoline Yellow Extra—(IG)	400
815	618	Tannoflavine T—(S)	500
833	—	Benzyl Fast Blue GL—(I)	
		Wool Fast Violet B—(IG)	
		Xylene Milling Blue GL Conc.—(S)	375
847	686	Irisviolet Extra—(IG)	15
873	681	Malta Gray J—(St.D)	661
875	923	Fur Blue Black A, SDF—(IG)	
		Fur Brown SP, NZ—(IG)	
		Fur Gray ALA, G—(IG)	545
878	622	Brilliant Delphine Blue B—(S)	1,000
879	—	Chromazurine G—(DH)	441
884	627	Chromacetine Blue S Extra—(DH)	441
905	645	Gallazine No. 90—(DH)	441
922	659	Methylene Blue B Conc.—(IG)	20
969	748	Hydron Blue R Powder (s. s.)—(IG)	333
1027	778	Alizarine Red VI Extra Pure Paste—(IG)	
		Alizarine Red VI Old Paste—(IG)	4,829
1033	779	Alizarine Orange AO Paste—(BD)	1,149
1034	780	Alizarine Carmine—(BAC)	
		Alizarine Red S Powder—(IG)	
		Alizarine Red S Powder—(Q)	
		Alizarine Red W Powder—(By)	2,701
1037	783	Purpurine—(By)	11,103
1040	784	Alizarine Red SX—(IG)	2,095
1053	—	Alizarine Sapphire Blue SE—(I)	440
1075	856	Alizarine Blue AS—(By)	676
1078	865	Alizarine Cyanine Green G—(By)	
		Alizarine Cyanine Green 3G—(By)	
		Alizarine Cyanine Green 3G—(IG)	668
1084	854	Alizarine Viridine FF Paste—(By)	
		Alizarine Viridine FF Paste—(IG)	5,980
1085	862	Alizarine Blue Black B Powder—(IG)	500
1088	855	Alizarine Blue SKY Powder—(By)	220
1091	—	Alizarine Rubine R Powder—(By)	
		Anthra Rubine B Powder—(K)	330
1095	759	Anthra Yellow GC Powder (s. s.)—(IG)	2,800
1096	760	Vat Golden Orange G Dbl. Pst. (s. s.)—(B)	1,056
1097	761	Vat Golden Orange RRT Paste Fine—(IG)	2,398
1099	763	Vat Dark Blue BOA Paste Fine—(IG)	2,460
1102	765	Vat Black BB Double Paste (s. s.)—(B)	770
1104	767	Vat Brilliant Violet RRP Powder—(IG)	1,000
1106	838	Vat Blue RSP Trile Powder (s. s.)—(IG)	900
1108	839	Indanthrene Blue RK Powder (. s.)—(By)	1,600
1109	840	Vat Blue 3G Powder (s. s.)—(IG)	1,000
1110	841	Vat Blue GGSNL Double Paste (s. s.)—(IG)	10
1113	842	Indanthrene Blue GCD Dbl. Pst. (s. s.)—(B)	3,520
1114	—	Vat Blue BCD Paste Fine—(B)	432
1116	847	Vat Green BB Powder (s. s.)—(By)	1,600
1118	849	Vat Yellow G Double Paste (s. s.)—(IG)	1,006
1120	867	Anthra Brown B Paste—(IG)	860
1132	817	Vat Yellow GK Powder (s. s.)—(By)	1,600
1133	819	Algol Red FF Extra Powder (s. s.)—(IG)	
		Algol Red R Extra Paste—(By)	3,198
1135	820	Vat Brilliant Violet RK Paste—(By)	573
1136	822	Vat Orange RRK Powder (s. s.)—(By)	800
1143	827	Anthra Bordeaux R Powder (s. s.)—(IG)	
		Vat Bordeaux B Extra Powder (s. s.)—(B)	2,560
1150	833	Vat Olive R Paste—(IG)	
		Vat Olive R Powder (s. s.)—(IG)	8,000
1151	—	Vat Brown R Paste—(By)	
		Vat Brown R Powder (s. s.)—(By)	5,568
1161	871	Vat Red Violet RRK Paste Fine—(B)	840
1162	831	Vat Red RK Paste—(B)	495
1172	794	Cibanone Black B Paste—(I)	1,102
1184	881	Brilliant Indigo 4B Paste Fine—(IG)	16,122
1186	883	Indigo MLB/6B Powder (s. s.)—(IG)	500
1190	885	Brilliant Indigo B Paste—(IG)	5,104
1207	912	Anthra Red B Paste Fine—(IG)	1,023
1211	910	Helindone Pink BN Paste—(IG)	1,000
1212	918	Ciba Red 3B Paste—(I)	
		Vat Red Violet RH Paste Fine—(IG)	10,509
1217	913	Hydron Orange RF Paste—(IG)	1,000
1222	901	Ciba Violet B Powder (s. s.)—(I)	6,610
1223	902	Thioindigo Brown R Powder (s. s.)—(IG)	375
1227	904	Helindone Brown G Paste—(IG)	500
		Thioindigo Brown G Powder (s. s.)—(IG)	375
1228	907	Anthra Scarlet 2G Paste—(B)	
		Thioindigo Scarlet 2G Powder (s. s.)—(IG)	2,132

UNIDENTIFIED DYES

Acid Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Alizarine Light Blue LR Conc.—(S)	500
Alizarine Light Violet RS Conc.—(S)	500
Alizarine Supra Blue A—(IG)	350
Amido Fast Red GG—(M)	671
Brilliant Acid Blue FF—(IG)	500
Brilliant Milling Blue B—(IG)	1,000
Brilliant Wool Blue FFR Extra—(IG)	600
Chrysoline A Powder—(IG)	50
Cloth Fast Yellow G—(I)	550
Fast Acid Marine Blue HBBX—(IG)	100
Guinea Fast Green B—(IG)	700
Guinea Rubine 4R—(IG)	100
Indocyanine B—(A)	551
Kiton Fast Red 4BL—(I)	2,645
Kiton Fast Red R—(I)	220
Lanasol Blue R—(I)	110
Metanil Red 3B Extra—(IG)	300
Milling Orange G—(IG)	200
Milling Yellow O—(IG)	400
Naphthol Black BGN Conc. for Printing—(IG)	300
Neolan Black GG—(I)	220
Neolan Blue BR, 2G, GR—(I)	3,086
Onis B, 3B—(IG)	200
Orthocyanine B—(IG)	500
Pilatus Fast Green BL Conc.—(IG)	125
Pilatus Fast Pink G—(IG)	100
Silk Yellow R—(IG)	200
Sulphon Yellow 5G, R—(IG)	300
Supramine Black BR—(IG)	700
Supramine Blue R—(IG)	200
Supramine Brown G, R—(IG)	400
Supramine Green BL—(IG)	50
Supramine Red B, 3B—(IG)	950
Supramine Yellow 3G, R—(IG)	420
Wool Blue 5B (free from salt)—(IG)	200
Wool Fast Orange G—(By, IG)	541
Xylene Milling Violet B Conc.—(S)	1,000

Vat Dyes

Alizarine Indigo 5R Paste—(IG)	1,000
Anthra Orange RH Paste Fine—(IG)	500
Anthra Pink R Extra Powder—(IG)	1,200
Anthra Scarlet B Paste—(IG)	500
Ciba Red RL—(I)	110
Cibanone Olive 2G Powder—(I)	110
Grelanone Yellow G Powder—(IG)	25
Helindone Printing Black RD—(IG)	8 000
Vat (Hydron) Brown R Paste—(C)	794
Hydron Pink FB Paste—(IG)	1,000
Hydron Pink FF Paste—(IG)	
Hydron Pink FF Powder (s. s.)—(IG)	2,200
Hydron Violet R Powder (s. s.)—(IG)	250
Indigosol Black TB—(IG)	100
Indigosol Violet AZB—(IG)	150
Thioindigo Rose RN Extra Paste—(IG)	100
Thioindigo Black B Paste for Printing—(K)	966
Vat Blue RZ Double Paste (s. s.)—(IG)	1 998
Vat Blue Green B Double Paste (s. s.)—(IG)	1.998
Vat Brilliant Blue R Paste Fine—(IG)	1,000
Vat Brown 3R Paste—(B)	485
Vat Gray 3B Double Paste (s. s.)—(IG)	489
Vat Green G Powder (s. s.)—(IG)	300
Vat Green GG Double Paste (s. s.)—(IG)	
Vat Green GG Powder (s. s.)—(IG)	1 810
Vat Pink B Double Paste (s. s.)—(IG)	1.500
Vat Printing Brown R Paste—(Q)	441
Vat Printing Violet RF Paste—(IG)	200
Vat Red GG Paste—(B)	386
Vat Red Brown R Powder (s. s.)—(IG)	400
Vat Yellow RK Powder (s. s.)—(IG)	500
Vat Yellow 3RT Conc. Powder (s. s.)—(IG)	500

Mordant and Chrome Dyes

Acid Alizarine Gray G—(IG)	500
Acid Anthracene Brown WSG—(IG)	1,000
Acid Anthracene Red 3BL—(By)	541
Acid Chrome Yellow 3GL—(IG)	100
Anthracene Chromate Brown EB—(IG)	1,000
Brilliant Chrome Blue S—(DH)	220
Brilliant Chrome Violet 3RA—(DH)	441
Chrome Fast Printing Red G—(G)	55
Chrome Printing Red Y—(DH)	441
Chromorhodine 6GN Extra—(DH)	441
Eriochromal Brown G Powder—(G)	110
Gallo Navy Blue DA Powder—(IG)	99
Metachrome Brilliant Blue BL, 8RL—(IG)	200
Metachrome Red G—(IG)	500
Radio Chrome Blue B—(IG)	1,000
Salicine Orange 2R—(IG)	100
Ultra Orange R—(S)	1,000

Direct Dyes

Benzo Chrome Brown B—(IG)	100
Beno Fast Black L—(IG)	1.300
Benzo Fast Blue 4GL—(IG)	300
Benzo Fast Bordeaux 6BL—(IG)	100
Benzo Fast Brown 3GL—(IG)	
Direct Fast Brown 3GL—(By)	941
Benzo Fast Copper Violet B—(By)	50
Benzo Fast Gray BL—(IG)	1,100
Benzo Fast Light Scarlet 4BL—(IG)	300
Benzo Fast Scarlet 2G—(IG)	120
Benzo Fast Yellow RL—(IG)	1,200
Benzo Green G—(IG)	100
Benzo Rhoduline Red B—(IG)	400
Brilliant Benzo Green B—(By)	220
Brilliant Benzo Violet 2R Powder—(By)	111
Brilliant Sky Blue 8G Extra Powder—(By)	551
Brilliant Pure Yellow 6G Extra—(IG)	300
Chloramine Fast Orange R Conc.—(S)	500
Chloramine Light Violet R Conc.—(S)	500
Chlorantine Fast Blue 2GL—(I)	2,204
Chlorantine Fast Blue 4GL—(I)	881
Chlorantine Fast Blue 8GL—(I)	2,424
Chlorantine Fast Green B—(I)	551
Chlorantine Fast Orange 2RL—(I)	220
Chlorantine Fast Violet RL—(I)	1,102
Chlorantine Fast Violet 2RL—(I)	1,102
Chlorazol Fast Brown RK—(BD)	500
Columbia Catechine 3B—(IG)	100
Cotton Black AC—(IG)	300
Diamine Azo Brown 3G—(C)	463
Diamine Azo Fast Violet R—(C)	760
Diamine Azo Light Yellow 2G—(C)	551
Diamine Bronze Brown PE—(IG)	100
Diamine Fast Blue FFB—(IG)	100
Diamine Fast Brown R—(IG)	750
Diamine Fast Orange EG, ER—(IG)	1 300
Diaminogene Blue GG—(C)	1,100
Diazanil Pink B—(IG)	300
Diazo Black VG—(I)	331
Diazo Brilliant Green 3G—(IG)	994

Diazo Brilliant Scarlet 2BL Extra Conc.—(By)	1,716
Diazo Brown 3G Powder—(By)	110
Diazo Brown 6G—(By)	200
Diazo Fast Blue 2BW—(I)	551
Diazo Light Yellow 3GL—(I)	441
Diazo Sky Blue 3GL—(IG, By)	684
Diazol Scarlet ???—(CN)	220
Diphenyl Dark Green BC—(G)	551
Direct Cutch Brown GR—(I)	1,102
Fast Cotton Rubine B—(IG)	100
Half-Wool Blue 3R—(IG)	2,156
Pluto Brown GG—(IG)	100
Rosanthrene RN—(I)	2,204
Rosanthrene Orange R—(I)	441
Rosanthrene Pink—(I)	551
Universal Blue C—(IG)	50
Universal Blue Black C—(IG)	225
Universal Brown C—(IG)	50
Universal Heliotrope C—(IG)	50
Universal Jet Black C—(IG)	150
Universal Leather Brown C—(IG)	50
Zambesi Black D—(IG)	500
Zambesi Black F—(IG)	500

Dyes for Artificial Silk

Blue Extra Paste—(IG)	100
Celatine Red Paste—(SD)	50
Duranol Blue G Paste—(BD)	324
Duranol Orange G Paste—(BD)	212
Duranol Red BB Paste—(BD)	536
Duranol Red G Paste—(BD)	480
Duranol Violet 2R Paste—(BD)	162
Ionamine L Paste—(BD)	60
Ionamine MA—(BD)	20
Ionamine Orange CB—(BD)	50
Ionamine Red GA—(BD)	50
Setacyl Direct Orange 2R—(G)	1,036
Setacyl Direct Red B Powder—(G)	1,102
Setacyl Direct Violet R Powder—(G)	772

Sulphur Dyes

Immedial Brilliant Green G Extra—(IG)	100
Indo Carbon CL—(IG)	2,000
Katigene Chrome Blue 5G—(By)	584
Katigene Indigo CLGG Extra—(By)	998
Pyrogene Brown G—(I)	441
Pyrogene Pure Blue 3GL—(I)	1,102
Thionol Brown O—(BD)	2,240
Thionol Brown R—(BD)	1,305
Thionol Green B—(BD)	14,991
Thionol Yellow GR—(BD)	1,293

Rapid Fast Dyes

Rapid Fast Red GZ Paste—(IG)	1,000

Basic Dyes

Basic Pink G Powder—(Q)	110
Rhodamine 6GDN Extra (s. s.)—(IG)	4,500
Xantho Phosphine G—(DH)	22

Color-Lake and Spirit-Soluble Dyes

Autol Orange Powder—(IG)	20
Hansa Yellow G in lumps—(IG)	900
Hansa Yellow G Powder—(IG)	20
Hansa Yellow GSA Powder—(IG)	3,000
Helio Bordeaux BL Paste—(IG)	1,385
Oil Green ALB in lumps—(IG)	50
Paper Fast Bordeaux B—(IG)	500
Stone Fast Scarlet G Powder—(IG)	20

Unclassified Dyes

Luxine Violet 5RN—(DH)	11
Soluble Blue I (old)—(IG)	20
Utopia Brilliant Green B Conc.—(NBC*)	10
Utopia Brilliant Green 6G Conc.—(NBC*)	10
Whitex Washing Blue—(Eze Mfg. Co.)	3,600

*North British Chemical Co.

Color Lakes of Coal-Tar Origin

Brilliant Pink Z Powder	25
Madder Lake Powder	544
Madder Lake VN Powder	625
Permanent Green H Powder	45
Permanent Green N Powder	25
Viridine Lake H Powder	600

The After-Treatment of Artificial Silk

Some Recent Patents

TWO recently discovered methods for dyeing fast oxidation black shades on cellulose acetate silk have considerable interest for dyers and printers, since no satisfactory method for applying aniline black to this type of artificial silk is available. Hitherto it has been possible to dye cellulose acetate silk black by means of logwood (with afterchroming), SRA Black IV, Celatene Black and Acetosilk Black, though none of the methods has been satisfactory in every respect. The black obtained with logwood has inferior fastness to light, and Celatene Black is expensive on account of the large percentage of dye required to get a full shade; SRA Black IV and Acetosilk Black yield black shades of excellent fastness, but, being developed colors, they are subject to all the disadvantages attending the application of dyes which require to be diazotized and coupled on the fiber.

It is now possible (E. P. 258,699) to dye or print materials containing cellulose acetate silk continuously, using 2:4-diaminodiphenylamine. This amine by itself, or together with aniline or similar amines such as are ordinarily used in dyeing Aniline Black, is very easily oxidized to a black shade having excellent fastness. Cellulose acetate silk may be dyed in an aqueous suspension or a solution of 2:4-diaminodiphenylamine (preferably in the presence of a solubilizing substance such as Turkey Red oil or Monopole soap) and then oxidized in any suitable oxidizing solution, or the silk may be slop-padded with a mixture containing the amine, an acid, an oxidizing agent, and a metallic catalyst, and afterwards aged in a warm, moist atmosphere for full development of the black. The same methods form the basis of printing processes. The second method (E. P. 255,962) is similar, but makes use of para-aminodiphenylamine instead of 2:4-diaminodiphenylamine.

Neither method has any appreciable deleterious effect on the handle and luster of cellulose acetate silk, and their importance increases when it is remembered that both

2:4-diaminodiphenylamine and para-aminodiphenylamine yield black shades on cotton under similar conditions (using the method of slop-padding and aging). There are distinct commercial possibilities in the dyeing of cellulose acetate silk and cellulose acetate silk cotton yarns and fabrics in fast oxidation black shades by continuous methods.

The hitherto so-called defects of cellulose acetate silk by which it becomes wooly and loses considerable luster when treated for a few minutes in boiling water now appear likely to be regarded as useful advantages. Recent discoveries (E. P. 246,879 and 260,312) have shown that the luster of cellulose acetate silk is preserved in boiling aqueous liquors by the presence of neutral inorganic salts, the degree of preservation being proportional to the quantities of such salts present. For example, cellulose acetate silk loses considerable luster when heated for one hour in a 1 per cent solution of common salt, but remains entirely unaffected under similar conditions in a 10 per cent solution. To-day there is a distinct demand for artificial silk materials having subdued luster, especially in fabrics of the crepe de Chine type, and it is in this connection that these protective salts are of particular importance.

Full-lustered cellulose acetate silk may be delustered to any desired extent by treatment in boiling solutions containing protective salts in sufficient quantity to preserve the full luster of the silk. Alternatively, the silk may be completely delustered by immersion in boiling water, and the luster then restored as required by treatment with boiling solutions of the same protective salts. By one or other of these methods it is possible to produce cellulose acetate silk materials having such luster effects as are desired by the buying public.

Some Japanese researches (Cellulose Ind. Tokio, 1926, 2, 25) have yielded interesting results relating to cellulose artificial silks which may be of considerable assistance to dyers and finishers. When cellulose silk fibers are wetted they increase in length by 10 to 65 per cent (average 40 per cent), and suffer a loss of tensile strength of 50 to 70 per cent. At the same time they become circular in cross-section, and the area of such sections increases 2 to 2.5 times. In a few instances it was noticed that fibers decreased in length when wetted.—Manchester Guardian Commercial.

TWO ACEKOS AMONG NEW CAMEL DYES

Three new Camel dyes developed by John Campbell & Co. have been placed on the market under the names of Aceko Fast Blue B, Aceko Cyanine R Conc. and Amidine Diazo Indigo Blue.

Aceko Fast Blue B is recommended especially for the dyeing of piece goods and is, according to the description, fast to acids, alkali and light. The Aceko Cyanine R Conc. is a sulphon cyanine of greenish tone recommended for the dyeing of navy blues on piece goods. It is dyed in a neutral bath and is said to have excellent fastness to salt water, light and other agents.

DRYSALTERS' MID-WINTER DINNER WELL ATTENDED

More than a hundred members of the Drysalters' Club gathered at the Copley-Plaza Hotel in Boston on Monday evening, January 24, for their Mid-Winter Dinner. S. R. David, the Drysalters' president, helped greatly to enliven the evening with a spirited talk on "Friendship" —the Keynote of the Drysalters' Club," which drew deserved applause from his hearers. The only regret expressed by those present was that the Mid-Winter Dinner is held only once a year.

CHEMIKER-ZEITUNG'S HALF CENTURY

To celebrate its fiftieth anniversary the Chemiker-Zeitung, published in Cothen (Anhalt), one of the leading periodicals of the German chemical and dyestuff industry, has issued a special number, containing a number of notable articles by leading European chemists. The rapid progress of Germany's dye industry after the war is described by Professor Duisberg. The past and future of the dyestuff industry is surveyed by A. u. Weinberg, and some very interesting personal reminiscences and experiences in the chemical industry are offered by Prof. Haber, Dr. W. Heracus and Dr. W. Merck and others prominently identified with the German chemical trade.

The issue also includes a history of the Chemiker-Zeitung by Prof. William Roth, for many years managing editor of the publication, which was founded in 1876 by Prof. G. Krauss.

DYESTUFF PLANT EXPLOSION STUDIED

Many chemicals are not always what they seem to be. A curious accident which recalls the mystery of the great Oppau explosion recently occurred at the dyestuff works of Hickson and Partners, Castelford, England, according to the London correspondent of Industrial and Engineering Chemistry. The explosion, which wrecked the works, occurred in the sodium dinitrophenate plant, and the question arises as to whether sodium dinitrophenate is for the future to be regarded as an explosive. It has not been so regarded, any more than ammonium nitrate was so regarded at Oppau, but the explosion was of such serious nature that it is being carefully investigated by the Home Office Explosive Department.

IMPORTS OF BACTERIOLOGICAL STAINS

The imports of bacteriological stains for the last six months of 1926 totaled 17,240 grams, with an invoice value of $1,819. The imports of reagents and chemicals totaled 11,935 grams, with an invoice value of $116.

Of the total quantity of bacteriological stains imported, 85 per cent came from Germany and 15 per cent came from England; by value, 76.5 per cent was from England, and 23.5 per cent from Germany. Of the total quantity of reagents and chemicals imported for the six months, 100 per cent—the entire amount—came from Germany.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

CLAYTON HOAGLAND
Managing Editor

MYRON DREW REESER
Advertising Manager

Published biweekly by
HOWES PUBLISHING CO., INC.
90 William Street, New York City

A. P. HOWES, *President* E. S. PREDMORE, *Secretary*

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00

Vol. XVI February 7, 1927 No. 2

METRIC MEASURES IN MERCHANDISING

THAT well-known statistician, Roger Babson, has called measurement "the master art which leads all arts and crafts, all industry and all commerce." It is strange that in this modern world of ours, where countries talk and buy and sell across the seven seas, this master art of measurement speaks no universal language. The reason is that American and British measurement units—the yard, quart and pound—have stubbornly stood their ground against the world-wide advance of the more efficient metric system.

How long we shall continue to follow old-fashioned measuring methods in the face of such overwhelming opposition it is difficult to say. There is now before Congress a proposal to introduce the metric system into general practice in this country in buying and selling. This bill, known as the Britten-Gillett Metric Resolution, provides simply that we shall standardize and decimalize our present yard, quart and pound—*standardize* them to sizes uniform with the principal metric units used by the vast majority of commercial nations; *decimalize* them to conform to our own simple decimal system of arithmetic and currency. If it is passed by Congress, the metric weights and measures will be used generally, in merchandising only, after 1935. Manufacturers will continue to use any measurements they desire.

The metric system, invented in 1783 by James Watt, has already been adopted by more than eight hundred millions of the world's people. The entire continent of Europe transacts its business under this system. Latin America, Russia, Japan and more than one hundred other countries have found the metric standards the most workable in daily buying and selling. The only civilized nations not on the metric basis in merchandising are the United States and Great Britain.

In this country metric measurement is commonly employed by engineers, scientists, chemists and other technical workers. The principal opposition to its general use has come from the public and from a few unprogressive manufacturing groups. The Britten-Gillett bill was consequently drawn up for the purpose of putting into everyday merchandising practice the convenient world standards of measurement that have found such widespread adoption here in technical work.

The positive position of science in relation to metric standardization is well known to all. Using metric units exclusively in scientific work, the scientists have proved the practical utility of these decimal measures and recommend them to commerce and industry. The National Research Council has declared: "We favor the extension by law of the use of the metric system in commercial transactions in the United States"; and scientific organizations are unanimously in accord with this. The American Chemical Society has been one of the notable leaders in the metric movement, in which all science joins.

The chemist in the mill laboratory who uses the metric system fully appreciates its simplicity and importance, even though he may not think of it as a "world system" of measurement. In making his tests he measures his slop-padding solutions or finishing starches in grams per liter, and perhaps even gauges machinery speed in meters; and yet his mill orders its dyes and chemicals by the pound and barrel, and when sending finished cloth abroad it measures it in yards that confuse the European who figures metrically.

The point in mind is that since the chemist is in such an excellent position to know the practical value of the metric standards, he can help to pass on their benefits to the people of the United States as a whole. This he can do by advocating the passage of this latest, and so far most practical, form of metric legislation—the Britten-Gillett Resolution. A petition to the Chairman of the Committee on Commerce, or even a note to your Congressman, will help speed the day when this country can take its place among those that use the scientific, standardized metric units of measurement.

TEXTILE STUDY AT THE BUREAU OF STANDARDS

A TEN-DOLLAR bill is not generally considered as a textile. Nevertheless the studies made at the United States Bureau of Standards on the wearing qualities of paper currency are mentioned in its latest annual report under the head of "Investigation of Textiles." The study of rubber compounds also falls into that class of technical work. In other words, out of the bureau's appropriation for textile research come the funds for the study of paper and rubber, as well as for the study of cotton and wool.

That appropriation is none too large for its purpose. In the past fiscal year $26,560 was set aside for the investigation of textiles at the laboratories of the Bu-

reau of Standards. At the end of the year only $39? of that amount remained. A new and larger appropriation of $30,000 has been provided for the current year's work in textile investigation, which is very encouraging. Furthermore, an additional $25,000 was requested in an amendment to the Department of Commerce appropriation bill. That item, however, was scratched off the bill a few days ago by the Senate Appropriations Committee because of certain large increases for other bureaus.

An effort will be made to have that extra appropriation of $25,000 for textile work replaced in the bill. Those who will make the effort are Southern Senators interested particularly in the study of cotton. More power to them! Every penny spent by the Government for textile research will in the end bring returns to the industry in dollars. Textile manufacturing is one of the major industries in this great industrial country, and it needs development as no other industry does.

For this reason why not have a special appropriation by the Bureau of Standards for textile research alone? According to the present division of the bureau's work, as we have pointed out, the study of rubber and paper is paid for with the money allotted to textile investigation. And, oddly enough, the study of the fastness of dyes on fabrics comes under the head of "Industrial Chemistry," and is paid for by another appropriation. Dyes are industrial chemicals, but their fastness on fabrics is a matter of fully as much importance to the textile manufacturer as to the dye chemist.

A section of the Bureau of Standards devoted exclusively to textile investigation would bring together all studies embracing textile manufacture, textile chemistry and dyeing. It would exclude studies on paper, rubber and other materials not strictly classed as textiles. This would make possible more extensive research without at first adding appreciably to the present appropriation, though even that would in time become inadequate. It would also correlate the studies of chemical and mechanical processes, which in the mill invariably bear a direct relation to each other. In fact, when the work is considered from all angles it is plain that the Bureau of Standards has a large and important problem on its hands in undertaking the investigation of textiles. Only by expert organization of the work and adequate funds can any marked progress be made.

The K. I. W. Dyeing Company, Paterson, N. J., recently chartered with a capital of $25,000, to operate a local dyehouse, will be represented by Fred W. Kraver, 74 Tyler Street, one of the incorporators. The other incorporator is Charles Williams.

RECENT LITERATURE

Annual Report of Director of the Bureau of Standards. Miscellaneous publications of the Bureau of Standards No. 75. Department of Commerce.

The United States Bureau of Standards has become a national institution, not only in its functions, but in the important place it has attained as a research organization. The scope of its activities is almost limitless. It is undoubtedly one of the largest and most active research units in the world. Its extensive laboratory studies have enriched both science and industry. In all its work it has endeavored to apply in practical form to large industrial problems the findings of every department of science.

The latest annual report of the bureau for the fiscal year ended June 30, 1926, reveals the full extent if its varied activities in establishing standard materials, products and processes. Contacts with industry are maintained on the one hand by advisory committees and on the other by research associates. There are approximately eighty of these advisory committees composed of technical representatives from the various industries interested in the bureau's work. The research associates are stationed at the bureau by the industry usually through trade associations, and during the past year there were sixty-two of these associates representing thirty-six industries, working on fundamental problems of immediate industrial concern. It is estimated that this work represents an outlay at the bureau of some $500,000.

Part of its chemical research work has been the development of improved methods of chemical analysis, among which may be mentioned an examination of reagent chemicals and a critical study carried out in co-operation with the American Chemical Society on methods of testing and in the preparation of specifications for these materials.

In routine chemical test work many chemical and physical tests have been conducted on a great variety of materials, such as paints, waterproofing materials, boiler waters and compounds, technical and photographic chemicals, soaps, adhesives, textiles and dyes. These tests serve to control the quality of Government purchases of these materials.

Laundering and Dye Studies

A study has been made of the changes in thermal insulating value of cotton blankets resulting from repeated laundering. The sample materials used in the experiments were representative of most common blanket types, and the laundering process corresponded to a good com-

mercial practice. Washing was found to cause small losses in thermal resistance (0 to 10 per cent), which were almost completely restored by the application of a suitable process for raising the nap of the laundered fabric. This result emphasizes the importance of such restoration of the nap. Shrinkage was also observed to produce a counteracting gain in thermal resistance.

In the bureau's studies in industrial chemistry pure dyes have been prepared and their transmissivity for light determined. Methods for analyzing dyes have been studied and an investigation, in co-operation with the American Association of Textile Chemists and Colorists, is now under way to determine the strength and purity of dyes and their fastness when used in textiles. Proposed methods of labeling commercial fabrics to indicate the fastness of color under various conditions have been considered, as well as the relation between the chemical constituents and the color of dyes.

Color Standardization

The bureau has endeavored to work out a consistent system of color standards. The eye is capable of distinguishing about one million different colors, no two of which match. To match in white light, two given colors must be alike in three attributes: brightness, hue (dominant spectral color), and saturation (percentage of white). There has been established as yet no system of color standards sufficiently precise and consistent for the demands of the trade, in which considerable financial loss often hinges on barely perceptible color differences, while the comparison standards used vary by a much greater amount. For several years the bureau has been working on the widely used Lovibond system of about 400 color glasses with the object of selecting out of these as adjusted color standards the ones which are consistent with each other as regards the three attributes mentioned. During the past year the spectrophotometric measurements on these glasses have been completed and are ready for publication. The colormetric measurement of the same glasses, which involves a revision of the three elementary excitations of the normal eye, is to be pushed to rapid conclusion.

During the year the Bureau of Standards published 158 new publications, making 1,290 publications as the total published work. A complete descriptive catalog (271 pages) was issued comprising all published matter from the establishment of the bureau in 1901 to June 30, 1925. A complete subject index permits instant reference to all published research. An annual supplement keeps the list and index current.

Dyestuffs and Coal Tar Products, Their Chemistry, Manufacture and Application. By Thomas Beacall, F. Challenger, Goeffrey Martin and Henry J. S. Sand. Fourth Edition Revised. 168 pages. Illustrated. $5.00. Van Nostrand Company.

As a treatise very broad in its scope and clear and concise in its treatment of the basic principles of coal tar chemistry, this volume should be extremely useful to the student. It forms, in fact, a readable introduction to the subject of dyestuff and coal tar chemical manufacture, with condensed information on the application of dyes to textiles and the various uses of the other products of coal tar dealt with in the text.

It is not, of course, intended as an exhaustive work on coal tar chemistry; it is entirely too abbreviated and elementary in treatment for that. But its material forms the groundwork for more extensive studies, and to this further reading the student is guided by the bibliographies appended to each chapter, though the literature listed therein is not in every case the most modern.

The chapters deal in turn with the industry of coal tar and coal tar products; the synthetic coloring matters; natural dyestuffs; dyeing and color printing; modern inks; saccharine and other sweetening chemicals; modern synthetic drugs, and photographic chemicals.

The A B C of Hydrogen Ion Control. By W. A. Taylor, Ph.D. 80 pages. Illustrated. LaMotte Chemical Products Company, Baltimore, Md.

During the past few years hydrogen ion control has been successfully applied to chemical processes in a number of widely different industries in addition to its more scientific application in pathological work. But to the average industrial chemist this method of determining acidity and alkalinity has been surrounded with a good deal of mystery—more, in fact, than it deserves to be burdened with. Consequently, its general introduction into textile chemical processing, for example, has been slow, and even the most authoritative papers on its use in dyeing and other processes have on the whole failed to clear up some of the important questions about pH value that trouble the average mill chemist.

In this interesting treatise the whole subject has been treated in the most elementary manner possible, to popularize it, so to speak, and at the same time present it intelligently, since it is assumed that those who would be most interested in the subject are men of some technical education. While about half of the book is devoted to the equipment used in hydrogen ion work, yet this does not detract one whit from the value of the more technical portion.

The contents of the book comprise, first, a non-technical discussion of the meaning of hydrogen ion concentration and pH values; second, a technical discussion for the chemist, bacteriologist, engineer, etc.; third, the application of pH control to over twenty different types of work, and fourth, a complete description of the various types of equipment for colorimetric work, together with full instructions for making determinations under all conditions.

The explanation of hydrogen ion control is exceptionally well written; a somewhat abstruse subject is covered in considerable detail in a lucid style. The

meaning of hydrogen ion concentration, the making of determinations, titration errors, buffer action—these and other technical phases of the subject are dealt with in a most instructive manner preliminary to a description of the various applications of pH determination to such processes as water purification, chemical analysis, industrial wastes, dyes and pigments, general chemicals, etc. The second section illustrates and describes the uses of the various block comparators, testing sets and other necessary equipment used in hydrogen ion control work.

The book will be sent upon request to the LaMotte Chemical Products Company, Baltimore, Md.

CHEMICAL TREATMENT OF TRADE WASTES

(*Concluded from page 88*)

acid and mix with the dye waste. If their volume were greater it would be economical to add them to the lime feed of the treating plant, but in this case the saving would not warrant the trouble.

Volume of Sewage for Discharge to Trunk Sewer

Since there is an allotment of 10,000 gallons of trade waste per day, the estimated 6,000 gallons of sludge from this plant and the 1,700 gallons of silk-and-cotton boil-off may be discharged directly to the sewer. If it were necessary to treat the sludge by filtration the settling would be made more efficient and it would run to filters, but there is no premium on efficiency in settling beyond a certain point, when a 10 per cent allotment is available.

Effect of the Effluent on Fish Life

The practical test on which the polluting or non-polluting character of waste is often judged is whether or not it prevents or destroys fish and plant life in the stream. The waste from this plant will flow through a dark lake stocked with goldfish. A series of tests on goldfish showed that the undiluted waste after treatment was only slightly toxic. When diluted it should offer no hazard to fish life.

Practicability and Cost

The method of treatment outlined has been studied in its application to several other plants, six of them similar to but larger than the one under discussion. In all but one case the plants were so departmentalized that by simple changes in accessible drainage lines the desired separation of wastes could be obtained. This includes a large plant which has been in operation for only a few months.

The cost of chemicals for treatment at current prices is about $8 a day. A revenue of approximately $5 per day is derived from the boil-off, giving a net cost of about $3 per day. In a larger plant it is usually possible to separate some of the wash waters without treatment, so that the total cost of treatment for a large plant is somewhat less than a direct multiple according to size.

English practice has shown separate treatment of soap and boil-off liquors to be more economical than their treatment as part of a mixed waste with dyes and other wastes.

Treatment Plant

The plant as designed has an averaging basin of 5,000 gallons capacity to operate with continuous inflow and overflow. The discharge from this will be a mixture containing varying amounts of the waste for several preceding hours. Not more than half of this will consist of inflow from the preceding half-hour, provided mixing is efficient. The settling basin has a capacity of 50,000 gallons, which allows for increase of plant facilities.

Summary

A plant dyeing both silk and silk-and-cotton goods has been investigated from the standpoint of waste purification. The wastes are dye liquors, two bleach liquors, two boil-offs, a mercerizing liquor, and a sour. The chemical characteristics of each are discussed. A half-hour average of dye waste treated with five pounds of copperas and four pounds of lime per thousand gallons settles satisfactorily. Decolorization is better with an hour average. One of the boil-offs goes to by-product recovery and the other is diverted to the sewer. Mercerizing liquors are neutralized and mixed with the dye wastes without pretreatment. Sludge is settled in a 4-hour detention basin and discharged to the sanitary sewer.

Acknowledgment

The results given in this paper were obtained in cooperation with Gerald W. Knight, consulting sanitary engineer of Passaic, N. J. They are published by permission of the Passaic Piece Dye Works, Passaic, N. J.

NEW FAST ACID BLUE ON NEWPORT LIST

An acid blue recommended for the dyeing of woolen piece goods, yarns, felt, shoddy, etc., in all types of machines has been announced by the Newport Chemical Works, Inc., under the name of Newport Fast Acid Blue SR. It is said to possess good general fastness properties, especially to light and salt water, and to be of special value for shading chrome navies and blacks and for dyeing wool in union materials from neutral baths. Effect threads of cotton and rayon, according to the description, are left white; white silk effects are only slightly stained.

Technical Notes from Foreign Sources

Condensation Products and Dyestuffs of the Benzanthrone Series

Iso benzanthrones are obtained by the action of alkaline condensing agents on a mixture of benzanthrone, not substituted in the 3 and 4 positions, with a benzyl halogenbenzanthrone having a free 4 position. The condensing agents used may be mixtures of caustic alkalies with alkali alkoxides in the presence of an inert dilutent, or metal arylides, such as sodium anilide, and oxygen, should be excluded during the reaction. By moderating the reaction, for example, by the use of a lower temperature, dibenzanthronyls are formed as intermediate products, and these may be further converted into isodibenzanthrones by the action of alkaline or acid condensing agents.

For example, a mixture of 20 parts of benzanthrone and 23 parts of benzyl chlorobenzanthrone is added, in a current of nitrogen, at a temperature of 5 deg. Cent. to sodium anilide, which is prepared from 6 parts of sodium and 400 parts of aniline, and the mixture is stirred for several hours, the temperature being allowed to rise to 12 deg. Cent. After removal of the aniline and extraction of the residue with acetone, 3:4'-dibenzanthronyl, yellow needles, melting point 326, is obtained. To convert it into isodibenzanthrone, 10 parts of it are added, in a current of nitrogen, to sodium anilide, which is prepared from 3 parts of sodium and 200 parts of aniline, at a temperature of 125 deg. Cent., and the mixture is heated at a temperature of 140 to 150 deg. Cent.

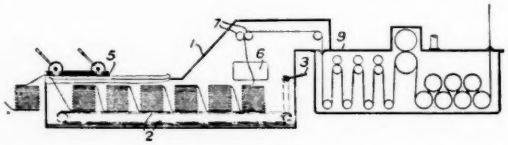
The following additional new compounds are described: 8-chloro-3:3'-dibenzanthronyl, brownish yellow, melting point above 360 deg. Cent.; 9-chloro-3:4'-dibenzanthronyl, melting point above 360 deg. Cent.; 8-methyl-3:4'-dibenzanthronyl, yellowish-green, melting point above 360 deg. Cent.; 8-Chloroisodibenzanthrone dyes cotton in much bluer and stronger shades than isodibenzanthrone. (British Patent No. 255,277).

Ripening of Viscose

The effects of temperature, light duration of ripening, and other influences on the ripening of alkali-cellulose have been determined by studying the colloidal properties of cuprammonium hydroxide solutions of the regenerated cellulose, the colloidal properties of the viscose solutions, and the physical properties of the resulting viscose pellicles. The relationship between intensity of color as measured by a Duboscq colorimeter and the degree of dispersion, observed by Svedberg in the examination of colloidal solutions of gold, has been found to apply in the case of cuprammonium hydroxide solutions of cellulose. The degree of dispersion of alkali-cellulose reaches a maximum after a relatively short period of ripening, and then slowly decreases. This point of maximum dispersion marks the optimum time of ripening, as is confirmed by an examination of the viscose solution and of the films which are prepared from it. Light and temperatures above 20 deg. Cent. have a deleterious effect on alkali-cellulose; there is, however, no necessity to conduct the ripening process in the presence of inert gases provided that free access of air is avoided. The best conditions of ripening are, therefore, five to twenty hours at a low temperature in a closed, opaque vessel which contains as little air as possible. (Cellulose Industry, Tokio, 1926, volume 2, pages 136-148.)

Dewaxing Fabrics

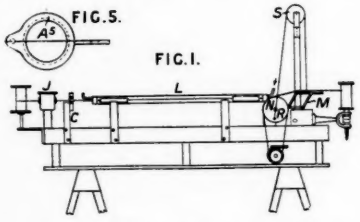
British Patent No. 257,491 is concerned with a process for dewaxing, degreasing, etc., of fabrics. It consists in slowly passing the fabric, arranged in folded piles, in series on a conveyor through a tank of solvent. The tank 1 in the figure is provided with a sliding door 5 and a conveyor 2 which is movable by means of a chain and



sprocket and handle 3. A pile of fabric is delivered adjacent to the door 5 and transferred to the conveyor each time a pile at the other end of the conveyor has been unfolded by the rollers 7 and passed to a washing tank 9, which may be of the kind described in British Patent No. 178,206. At least one inspection window 6 is provided at the delivery end of the tank 1.

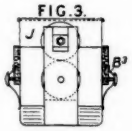
Treating Yarns with Liquids

Cotton yarns are impregnated with solutions of cellulose or its derivatives to produce a washable finish with simultaneous mercerization of the cotton by apparatus comprising a "doping" tank J, one or more dies or grooved



rollers mounted at C, drying tube or chamber L, through which a countercurrent of air is passed, and a traverse mechanism such as M for the winding bobbin. This mechanism comprises a thread carrier mounted on a

parallelogram frame raised and lowered by a cord passing over a pulley S and connected to a stud R on a wheel N. The tank J is provided with rollers immersed in the dope,



and the inlet and outlet dies are of sapphire or equivalent, secured by clips B^3 (see Fig. 3). Split dies may be used in a holder mounted at C comprising a spilt metal tube A^5 (see Fig. 5), grooved to receive the discos holding the dies. (British Patent No. 257,097.)

Effect of Aftertreatments on Fastness to Light of Dyeings with Naphthol as Compounds

Cotton which has been dyed with Naphthol ASSW and Fast Red KB base contains the resulting yellowish-red pigment uniformly distributed throughout the cell wall, the cuticle and lumen being free from pigment, but during subsequent soaping for one-half hour at the boiling point the pigment becomes crystalline and bluish red, and the greater part migrates to within the lumen. This behavior, which confirms the observations of Haller and Ruperti (Berichte, 1926, page 316), is more readily seen in fibers which are swollen by means of caustic alkalies or cuprammonium solution, so that the cell wall (cellulose) occupies about two-thirds and the lumen one-third of the fiber.

Migration of pigment does not occur in boiling water or boiling solutions of sodium chloride (about 109 deg. Cent.), but does occur in boiling water which contains an alkali and also to a limited extent in solutions of soap which contain sodium chloride. Migration is dependent on swelling of the cotton cellulose and is accompanied by an increase of fastness of shade to light.

For example, shades produced on cotton by means of Naphthol AS and Fast Red GL base and Naphthol ASSW and Fast Red KB base, afterwards washed in cold water and soaped at temperature of 50 deg. Cent., 75 deg. Cent. and the boiling point showed increasing fastness to light. Photomicrographs of sections of dyed fibers before and after soaping are given. Changes of shade produced by aftertreatment are due to optical effects and not to change of constitution of dyestuffs. (Melliand's Textilberichte, 1926, volume 7, pages 437-440.)

Reserves Obtained by Means of Algin

"Algin," or "norgin," a product which contains alginic acid, and which is obtained from seaweed, forms soluble sodium and magnesium salts, but with salts of alkaline earth and heavy metals it yields insoluble horn-like products which resist the penetration of dye liquors, and may therefore be used in reserve pastes for printing and batik dyeing. Veined batik effects are obtained by impregnating the fabric with an 8 to 10 per cent solution of algin, drying, coagulating with a suitable metallic salt, washing and then drying again. These effects are exceptionally clearly delineated. Fabrics that are prepared in this fashion are superior to those prepared in the usual manner with wax, since they may be calendered, heated or steamed without reducing its resist properties.

A particularly suitable method for preparing fabric with algin consists of impregnating it with an ammoniacal solution of copper sulphate which contains algin and subsequently fixing the copper alginate in an insoluble form by steaming. Algin resists on fabric are removed by successive treatment with an acid and a weak alkali, for example, sodium carbonate, so that only dyes fast to these treatments may be used. (Melliand's Textilberichte, 1926, volume 7, pages 538-539.)

Jigger Machine for Dyeing Fabrics

To adjust the tension of the fabric in a jigger machine by varying the relative speeds of the rollers, oppositely disposed cone pulleys 11 and 12, on the shafts of the upper rollers, 7 and 8, are connected by a belt 13 whose position is adjusted by a fork 15 traversed by a nut on a screwed shaft 14 rotated through worm gearing 16 by one of two handwheels 18. The lower roller 9 has a pulley 21 fixed or splinted on its shaft by which it is driven by a crossed belt 20 on a cone pulley 19 on the shaft of the roller 7. Handwheels 26 operate by similar screws one or two belt forks 25 to control the speed of the roller 9. The upper rollers are driven alternately from a main driving shaft 29 by a double friction cone 28 engaging one or other of the friction cones 27 under the control of a handwheel 35 rotating by a chain 33, a screw shaft 31 traversing a fork 30. (British Patent No. 258,736.)

Bleaching Vegetable Fibers

The following is a new method of bleaching which possesses some originality. The process commences with the boiling-out of the cotton, in which process a sulphoricinoleate is used as an assistant. After washing, the cotton is placed in a cold bath which contains from 8 to 10 per cent of a 30 per cent caustic soda lye, based on the weight of the cotton. The next morning the cotton is removed, rinsed and then acidulated with a 2 per cent sulphuric acid solution, and if the waters are calcareous, with 1½ per cent of 66 deg. Be. sulphuric acid and 0.8 per cent of 20 per cent hydrochloric acid. The cotton is again rinsed.

It is then placed in a bath which contains 4 per cent of potassium permanganate and 10 per cent of a 20 to 21 per cent hydrochloric acid The hydrochloric acid very slowly reduces the permanganate and manganese dioxide is fixed on the cotton fibers. After being passed through for five to seven turns, 3 per cent of potassium permanganate is added without any acid. The cotton is washed and treated in a bath containing 11 per cent of

35 to 38 deg. Be. sodium bisulphite liquor and 15 per cent of hydrochloric acid. The cotton is washed again and is again placed in the non-exhausted potassium permanganate liquor after about 5 per cent of denatured alcohol had been added to it. The potassium permanganate is very rapidly reduced after the addition of the denatured alcohol and by still further increasing the proportions of denatured alcohol, potassium permanganate and acid sensibly increase the deposition of the manganese dioxide on the cotton fiber. (Revue Generale T. I. B. A., August, 1926.)

SURE SHOTS FOR SALESMEN

By Stanley Schultz

It has been brought to my attention that a number of young men and men with young ideas believe that they would like to run around the country and have some railroad throw cinders in their faces. Why they should want to leave the family nest to eat hotel hash and sleep alone is beyond me. Of course, with married men—well, any way, since they have this ambition to be dressed-up bums it is up to us to help them all we can, and it is with this thought in mind that I have prepared these helpful hints.

Instructions in salesmanship are always divided into three parts: Approach, Getting the Order, and Getting Out. We will take these in the order named. First, Approach.

In order to Approach a man you must first find him. An excellent training for this is to look for him in the sizing room of a hat shop on a winter's day. If you have no hat shop near you, pick out the largest mill you can find and play hide and seek with one of their roving superintendents. If it is in the summer, you will find him at the company garage watching one of the company mechanics fixing his car; but if it should be in the winter, you will find him in the boiler room telling the chief engineer how he ran his car twenty thousand miles and never once lifted the hood. If you cannot find him in either of these places, regardless of the season, find the center of the mill and make a noise like a chorus girl with a sprained ankle. This is sure to bring him on the run; but it will be best to get behind the largest machine you can find, or you'll be killed in the rush.

There are some men whom at first glance it seems impossible to reach. They are surrounded by several secretaries, whose duty it is to see that their boss is not disturbed while he holds his private stenographer's permanent wave. Do not let all these things bother you or get you fussed. Just walk up to the first secretary you see and ask for Mr. Jones. When he, she or it asks you what you want to see Mr. Jones about, reach into your pocket and show him, her or them a corkscrew. Oh, the joy that will be yours! Open sesame. It never fails. The unseeable Mr. Jones will greet you with a grin such as was worn by the cat who ate the canary.

Now comes the important part. You are face to face with the prospect and still alive, and here comes the Approach stuff. Never greet the man as if you expected an order. Your expression should be one of sweetness and purity. I know where to get a full supply of sweetness, but you will have to furnish your own purity. Hard luck! Walk right up to your customer-to-be and greet him with some light, easy remark; something which will open the door for you and show him that you are a good fellow and willing to play—such a remark as, "Well, well, see who's here! If it isn't Santa Claus!" This, if accompanied with a hearty slap, will make a great hit. It is sure to open the door for you.

Here endeth the first lesson. In my next I will tell how to get the order. In the meantime, I think I'll go out and get a little practice.

CORRECTION

In an article appearing on page 814 of the December 13, 1926, issue of The Reporter the Swiss firm of Heberlein & Co., Ltd., was erroneously mentioned as being a German company. Although this article was a translation from Melliand's Textilberichte, The Reporter gladly takes this opportunity to correct the error, since it may easily have been made in translation.

Contract has been awarded by the American Cellulose & Chemical Company, Ltd., for an extension to its dye plant at Amcelle, near Cumberland. An increased production of Celanese yarns and fabrics is contemplated.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

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